Dolby

Model CP45
Cinema Processor
Installation and Alignment Manual

Issue 2 Part No. 91389

Dolby Laboratories Inc

U.S. Headquarters

Dolby Laboratories Inc
100 Potrero Avenue
San Francisco, CA 94103-4813
Telephone 415-558-0200
Facsimile 415-863-1373
www.dolby.com

U.K. European Office

Dolby Laboratories
Wootton Bassett
Wiltshire SN4 8QJ England
Telephone (44) 1793-842100
Facsimile (44) 1793-842101

If you purchased the Model DP562 through a dealer or systems integrator, please contact them for technical support.

DISCLAIMER OF WARRANTIES: Equipment manufactured by Dolby Laboratories is warranted against defects in materials and workmanship for a period of one year from the date of purchase. All warranties, conditions or other terms implied by statute are excluded to the fullest extent allowed by law.

LIMITATION OF LIABILITY: It is understood and agreed that Dolby Laboratories' liability whether in contract, in tort, under any warranty, in negligence or otherwise shall not exceed the cost of repair or replacement of the defective components and under no circumstances shall Dolby Laboratories be liable for incidental, special, direct, indirect or consequential damages (including but not limited to damage to software or recorded audio or visual material), or loss of use, revenue or profit even if Dolby Laboratories or its agents have been advised, orally or in writing, of the possibility of such damages.

Dolby and the double-D symbol are registered trademarks of Dolby Laboratories.

(c)1999 Dolby Laboratories Inc.

Issue 2
S99/10760/12718
Part No. 91389

TABLE OF CONTENTS

INTRODUCTION AND SPECIFICATIONS i

SECTION 1
EQUIPMENT REQUIRED 1-1

SECTION 2
INITIAL SET-UP AND INSTALLATION 2-1

2.1 Replacing an Existing Sound System 2-1
2.1.1 Before playing the film 2-1
2.1.2 While playing the film 2-1
2.1.3 Disconnect the old system 2-2
2.2 Mount the CP45 2-2
2.3 Connect the CP45 2-2
2.3.1 Aux/Non-sync2 Inputs 2-2
2.3.2 Remote Fader(s) 2-3
2.3.3 Mute 2-3
2.4 Jumpers and Switches 2-4
2.4.1 Backplane Jumpers and Switches 2-4
2.4.2 Output Signal Test /Hearing Impaired Signal Select Switches 2-5
2.4.3 Cat. No. 513 Jumpers 2-6
2.4.4 Cat. No. 510 Switches 2-8
2.5 Mains Power Wiring 2-10
2.6 Connect the Transformers to AC Mains Power 2-11
2.7 Hum Problems 2-11
2.8 CP45 Circuit Card Descriptions 2-18
Cat. No. 510/514 Input/Output Card 2-19
Cat. No. 511 Main Board 2-19
Cat. No. 513 Equalization Board 2-20
Cat. No. 513 Equalization Board 2-20
Cat. No. 222A Module 2-21
Cat. No. 222SR/A Module 2-21
Cat. No. 516 Remote Unit 2-21

SECTION 3
AN OVERVIEW OF THE ALIGNMENT PROCEDURE 3-1

3.1 Aligning the A-Chain 3-1
3.2 Aligning the B-Chain 3-1

SECTION 4
A-CHAIN ALIGNMENT 4-1

a. Preliminary Procedures 4-1
b. Optical Preamplifier Adjustments 4-6

SECTION 5
B-CHAIN ALIGNMENT 5-1

5.1 Check Theater Equipment 5-1
5.2 Setting Room Equalization 5-2
5.3 Adjusting L,C,R Output Levels 5-16
5.4 Subwoofer Alignment 5-18
5.5 Setting Optical Surround Delay 5-19
5.6 Non-sync Level Adjustment 5-34
5.7 Final Check 5-36

SECTION 6
REFERENCE DIAGRAMS 6-1

CP45 Signal Path Block Diagram 6-2
CP45 Backplane Schematic 6-3

APPENDIX A
EFFECT OF CHANGES IN SLIT HEIGHT ON SLIT LOSSES.....A-1

INTRODUCTION AND SPECIFICATIONS

About The Dolby CP45

The Dolby Model CP45 combines the high performance for which all processors manufactured by Dolby Laboratories are well known with a new cost-effective integrated design. The CP45 is the heart of your theatre sound system. All sound sources are connected to the CP45 which processes their signals appropriately and feeds them to the power amplifiers.

The CP45 precisely complements the techniques used in the preparation of Dolby Stereo optical releases. By providing a stereo optical preamp with precise slit-loss correction, professional Dolby A-type noise reduction and Dolby Spectral Recording, an advanced 2:4-channel decoder, and multi-band screen speaker equalization, the CP45 ensures accurate reproduction of Dolby A-type and SR releases. It has also been designed for convenient interface with theatre automation systems.

Among the standard features of the CP45 are a built-in fader with remote and mute facilities; simple push-button soundtrack format selection; and comprehensive fail-safe features that include a built-in bypass system.

The following sound formats are supported:

Format	**Number**
Mono	01
Dolby Stereo A-type	04
Dolby Stereo SR	05
Non sync 1	60
Non Sync 2 / Aux	61
Microphone	64

About this manual

This manual is intended to be used by individuals who are qualified in the area of cinema sound service. The basic day-to-day operation of the CP45 is covered in the **CP45 Users' Manual**.

This installation and alignment manual covers the procedures necessary to ensure that the theatre sound system is accurately aligned to standards that have been established by Dolby Laboratories. Following these procedures will ensure that the theatre sound system will accurately reproduce the soundtrack as the director and sound mixers intended.

The Dolby Cinema Processor is the central element of the theatre sound system. The projector, the Dolby Processor, the power amplifiers and the loudspeakers, as well as the auditorium itself, must be considered when aligning the system for optimum performance.

The system alignment procedure is divided into two parts—the A-chain alignment which covers the projector, optical preamplifier, and Dolby noise reduction adjustments—and the B-chain alignment which covers the portions of the system from the room equalization circuits to the CP45 fader through to the loudspeakers.

The alignment instructions in this Manual are presented in three columns. The first column, **Action**, contains a drawing of the item to be adjusted and a caption containing a brief description of the action to be taken. The second column, **Indication**, contains a visual indication of the desired results, where applicable. The third column, **Notes**, contains information which amplifies and supplements the other two columns.

If you are familiar with alignment of other Dolby Cinema Processors you need to follow only the information in the first two columns. If you are unfamiliar with the equipment or face special situations that require complete information you should consult the **Notes** column.

CAUTION

This Installation Manual is for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in the Users' Manual unless you are qualified to do so.

SPECIFICATIONS

Construction
Rack-mount chassis frame construction with plug-in modules accessible behind hinged front panel.

Signal connections
Standard pluggable screw-type terminal blocks for audio signals and control connections for projector changeover. Mating halves supplied for each terminal block. Automation connections via 15-way D-type connector. Power supplied via two outboard wall-mount transformers (one main, one bypass).

Signal Inputs
a) Optical: two pairs of balanced inputs for two projectors with stereo solar cells (available from Dolby Laboratories mounted on brackets for most projector types).
b) Digital / Magnetic / Aux.: six inputs for use with external magnetic preamplifier, digital adapter, or auxiliary source, 300 mV operating level (100mV for sub input).
c) Non sync: one pair of inputs for stereo non sync source, 10 k nominal input impedance, 30 mV maximum input sensitivity. 2:4 decoder may be used to generate ambient information for surround speakers with stereo non sync sources.
d) Mic input: for dynamic microphone, 1k nominal input impedance.

Signal outputs
150 ohm output impedance will drive any load greater than 600 ohms. Maximum output level, 2 V rms. Typical operating level, 100 mV. Operating levels from 10 mV to 200 mV may be accommodated.

Output for hearing-impaired
Center-weighted sum of L, C, R, S for connection to auxiliary system for the hearing-impaired. Output impedance 2.5k ohms.

Optical preamplifier
Cat. No. 510 stereo preamplifier for two projectors equipped with stereo solar cells. Adjustable sin (x) / x slit-loss equalization circuitry for flat response from virtually any type of optical sound head.

Noise reduction
Two channels each for Dolby A-type and Dolby SR soundtracks.

Four channel decoder
Cat. No. 511 2:4 decoder derives left, center, right and surround channels from two tracks on Dolby stereo optical prints. Incorporates modified Dolby B-type noise reduction and 10ms-150ms adjustable delay line to optimize front-to-back surround separation.

Loudspeaker equalization
a) Cat. No. 512 equalizers for left, center, and right screen speakers provide ±10 dB high- and low-frequency controls, plus 7 adjustable ±8 dB narrowband filters with 2 / 3 octave center frequencies from 63 Hz to 2 kHz. Adjusted by trained installers to achieve standardized Dolby cinema playback response.
b) Surround equalizer provides bass, mid-frequency, and treble adjustments for left and right surround channels,
c) 50 or 100 Hz crossover for subwoofer channel.

Noise level
Typically -65 dB (CCIR / ARM weighted) referenced to Dolby level.

Distortion
Any channel, 1 kHz: typically less than 0.15% at Dolby Level (50% modulation).

Ambient operating temperature
Up to 40˚C.

Dimensions
3 units high rack mounting: 178 x 483 mm (7’x19'). Maximum projection behind mounting surface: 280 mm (11'). Maximum projection in front of mounting surface: 40 mm (1.6”’).

Weight
10.1 kgs (22.3 lbs).

Power Requirements
Normal supply 24VAC at 1A
Bypass supply 24VAC at 200mA

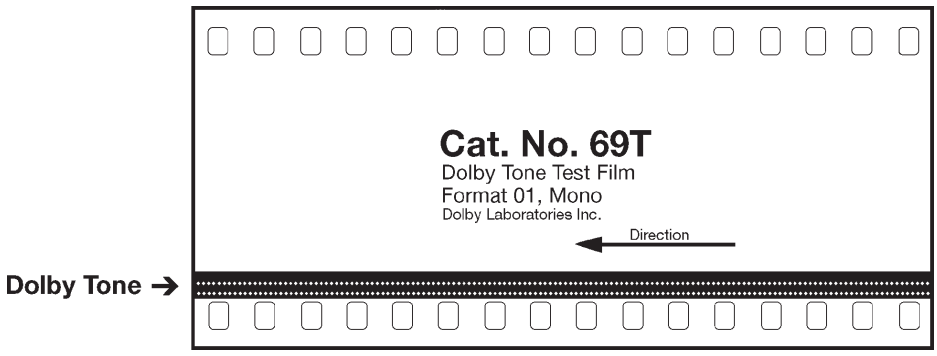
Fuse requirements
One slow-blow fuse: 20mm, 1.5 A. Spare fuse provided.

Options
Cat. No. 515 second surround channel module.
Cat. No. 516 remote fader.

SECTION 1
EQUIPMENT REQUIRED

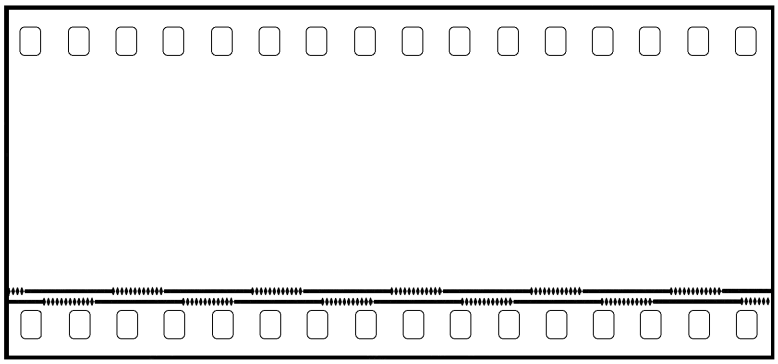
The following equipment is required for proper installation and alignment of the CP45 Cinema Processor.

- Dual-trace oscilloscope with X-Y facilities.
- 1/3 Octave Real Time Spectrum Analyzer (RTA) with calibrated microphone. (Preferably multiple microphones and a multiplexer should be used.)
- Sound Pressure Level Meter (with slow time-constant and C weighting scale).
- Voltmeter for measuring the exciter lamp power supply.
- Test Films, available from Dolby Laboratories or equipment dealers. We recommend that you make loops of these test films, sufficiently long to go through the entire projector film path so that azimuth and lateral film position adjustments can be made accurately.

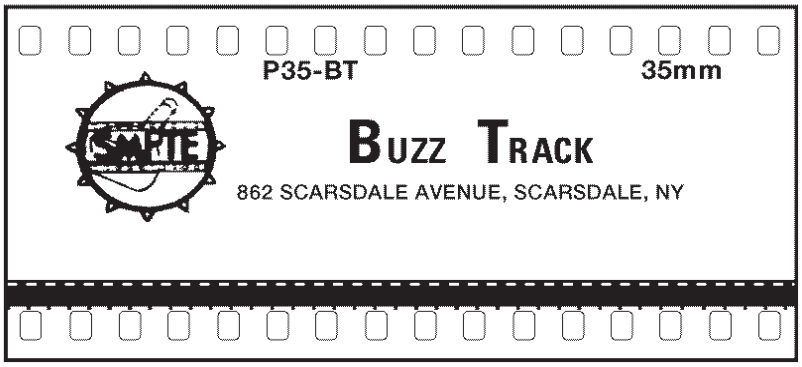


1. Dolby Tone — Cat. No. 69T

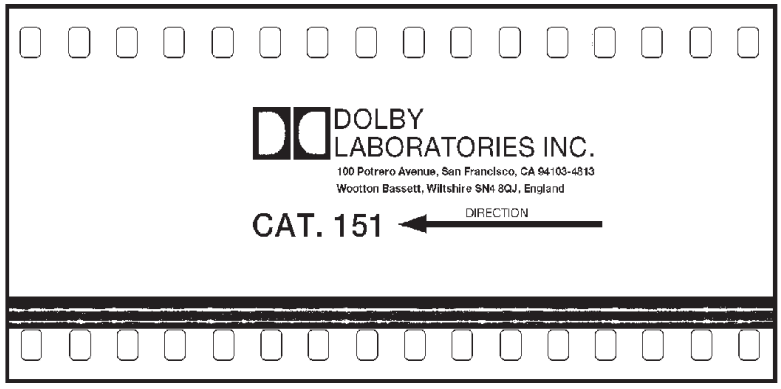
2. Pink Noise — Cat. No. 69P



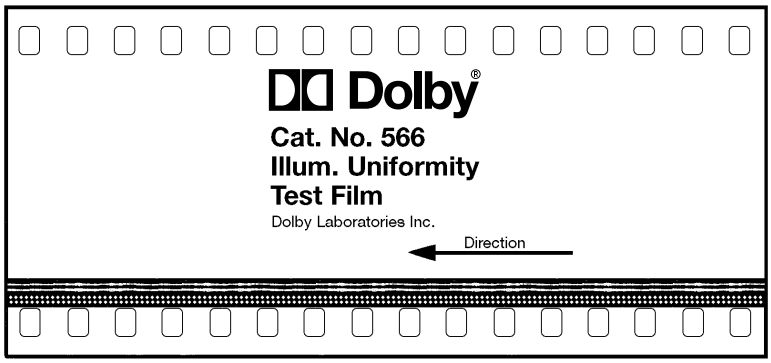
3. 1kHz, 100% Modulation, Left/Right — Cat. No. 97



4. SMPTE Buzz Track



5. Stereo Optical Surround Level — Cat. No. 151



6. Illumination Uniformity — Cat. No. 566

7. "Jiffy" Test Film — Cat. No. 251

SECTION 2
INITIAL SET-UP AND INSTALLATION

Do NOT connect the CP45 to mains power until all connections have been made and all jumpers have been checked or set.

If air-conditioning noise is audible in the theater, arrange for lubrication of the motor, fan bearings, adjustment of belts and drives, and cleaning of filters to reduce the ambient noise to a minimum. If the air-conditioning cannot be repaired switch it off while the CP45 is being aligned.

2.1 Replacing an Existing Sound System

If the CP45 replaces an existing cinema sound system, play a typical film before you remove the old system so you will have a benchmark for comparison to the new system and as a check of the positioning of the exciter lamp, the focusing of the sound track lens, and the condition of the solar cell.

2.1.1 Before playing the film:

- Verify that the existing power amplifiers are in good working order.
- Verify that the existing speakers are in good working order, and that there is no loose or missing hardware, structural parts, or damaged drivers in the enclosures.
- Verify that all wiring is present and properly connected and that crossovers are operating and are correctly adjusted.
- Check the polarity of the speaker connections.
- Verify that there are adequate earth (ground) connections.
- Verify that radio interference problems are adequately resolved.

2.1.2 While playing the film:

While you run the film, listen carefully in various parts of the theater for audio system problems:

- Hum.
- Noise, clicks, pops.
- Distorted sound.
- Poor tonal balance (lack of high-frequency or bass content).

These problems must be resolved before you can proceed with the new installation.

2.1.3 Disconnect the old system

Disconnect power from the existing cinema sound equipment.

Mark each cable to an existing sound processor identifying its function, then disconnect the cabling. Leave the cables connected to the power amplifiers, booth monitor, etc.

2.2 Mount the CP45

Open the front panel and confirm that all modules and and circuit cards are seated properly.

Close the front panel and cut the cable ties located on the bottom of the unit used for shipping the Cat. No.222 SR/A module in the CP45.

To avoid heat problems, do not mount the Dolby CP45 immediately above or below the power amplifiers. Locate the power amplifiers away from the CP45 to avoid hum pickup problems.

Always leave a 1U (43 mm, 1.75") space above and below the CP45 to provide adequate ventilation. Install an air guide or baffle to deflect hot air from equipment below the CP45.

2.3 Connect the CP45

Refer to the fold-out pages located at the end of this section. Use the appropriate pages for your installation.

Make input and output signal connections by inserting stripped and tinned leads into the supplied cable connectors and tightening each lead in place by means of the integral set screw. The cable connectors are then plugged into place at the corresponding locations shown on the fold-out wiring diagrams. To provide proper operation in locations where there is a large RF or other interference field, ensure that the cable types, lengths and pin assignments are strictly adhered to. Shields must go only to the chassis lugs and should not be paralleled with the "–" side of inputs or outputs.

NOTE: Follow all local codes and regulations covering electrical wiring. It is recommended that conduit be used for wiring runs.

2.3.1 Aux/Non-sync2 Inputs

If the installation of AUX/Non-sync 2 leaves any inputs unterminated, these should be shorted with links across + & – inputs.

If AUX/Non-sync 2 is used for background music, this is best wired to the surround input(s) so that it plays to the surround speakers in the auditorium to prevent the muffling effect of the curtains when these are closed. If the background music is stereo, then the feeds should be wired to the two AUX surround inputs. If no second surround card (Cat. No. 515) is present, the feeds will be summed to mono and sent to the left surround output. With a Cat. No. 515 present, the surrounds will appear in stereo.

2.3.2 Remote Fader(s)

If the remote volume control has a resistance of greater than 10K, a parallel fixed resistor(s) needs to be added to bring the maximum resistance down to 10K when the pot is at its maximum clockwise rotation. Bear in mind that although there will be control over the volume, the fading action will not then match the linear 0-10 scale. For example, if the pot is 22K linear, then the parallel resistor should be 18K. For a 47K linear pot, the value would be 13K. Values above 47K are not recommended.

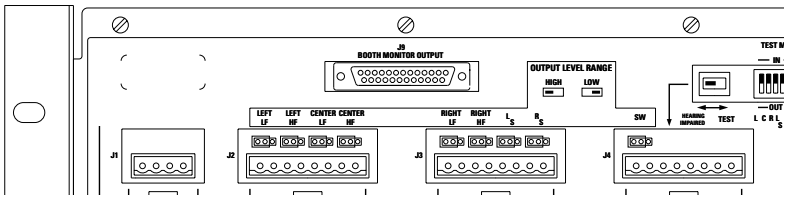
Bear in mind when installing a remote fader that selection of the remote will not be possible until pin 2 of the remote connector is grounded. This is a safety measure to ensure that the local fader resumes control if the remote becomes unplugged.

2.3.2 Mute

The mute switch on the Cat. No. 516 Remote Unit is a simple locking pushbutton. Mute is not cancelled by the selection of a format. If format change muting is required, a simple grounding of pin 13 on the remote connector during the format change is usually enough to ensure quiet format changes since, on its own, the mute system takes about 150mS to restore the volume to its original level when pin 13 ground is removed. If longer format change muting times are needed then a resistor-capacitor can be added between pin 13 and pin 4 (ground). The capacitor should be electrolytic, must have its negative terminal connected to ground (4), and be 10V or higher. As a broad rule, a 100uF 10V capacitor in series with 100ohms 20% 1/4W between pins 4 and 13 introduces approximately a 1 second delay before the volume returns to normal.

2.4 Jumpers and Switches

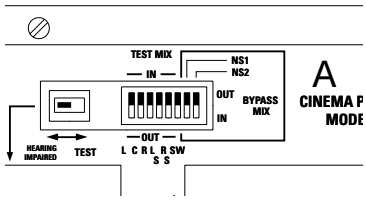
2.4.1 Backplane Jumpers and Switches



These jumpers set the output signal level range for each channel. They are set at the factory for a power amplifier input sensitivity of between 90 mV and 1.23 V. If the power amplifiers used in the installation are very sensitive (10 mV to 100 mV input sensitivity), it may be necessary to move these jumpers to the **LOW** output position. If you are unsure of the sensitivity of your power amplifiers, set to the **LOW** position initially. If the **HIGH** output position is required this will be determined during alignment.

Left LF	**Left Channel Low Frequency** output (used for both full-range and bi-amplified systems)
Left HF	**Left Channel High Frequency** output (used only in bi-amplified systems)
Center LF	**Center Channel Low Frequency** output (used for both full-range and bi-amplified systems)
Center HF	**Center Channel High Frequency** output (used only in bi-amplified systems)
Right LF	**Right Channel Low Frequency** output (used for both full-range and bi-amplified systems)
Right HF	**Right Channel High Frequency** output (used only in bi-amplified systems)
Ls	**Surround** output (with optional Cat. No. 515 installed–**Left surround**)
Rs	**Right Surround** channel output (with optional Cat. No. 515 installed).
SW	**Subwoofer** output

2.4.2 Output Signal Test /Hearing Impaired Signal Select Switches



These switches select which CP45 output signal(s) are sent to connector J4 terminals 3 and 4.

With HEARING IMPAIRED/TEST switch set to **HEARING IMPAIRED**:
L, C, R, and S are combined for use with a hearing impaired system. The individual channel switches are not active.

HEARING IMPAIRED/TEST switch set to **TEST**:
This function is used for testing purposes. As each test mix switch is set to **IN**, the corresponding channel is added to the output terminals.

L	Left
C	Center
R	Right
Ls	Left Surround
Rs	Right Surround
SW	Subwoofer

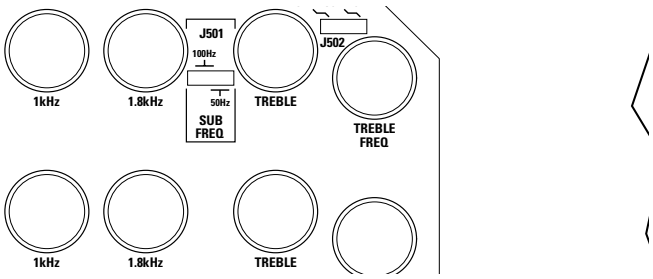
BYPASS MIX Switches

These switches provide a path for non-sync signals to reach the CP45 output when the unit is in bypass mode.

Bypass mix switch set to **OUT**:
Casette tape music (for example) will not be heard when the unit is switched to bypass. This is the factory setting.

Bypass mix switch set to **IN**:
Non-sync sources will be mixed with projector sound inputs when the unit is switched to bypass.

2.4.3 Cat. No. 513



Subwoofer Jumpers

Jumpers for controlling the subwoofer channel are located on the Cat. No. 513 equalization board. To gain access to these jumpers, open the front panel and remove the plate covering the equalization controls.

J501 Subwoofer Upper Frequency Limit Setting

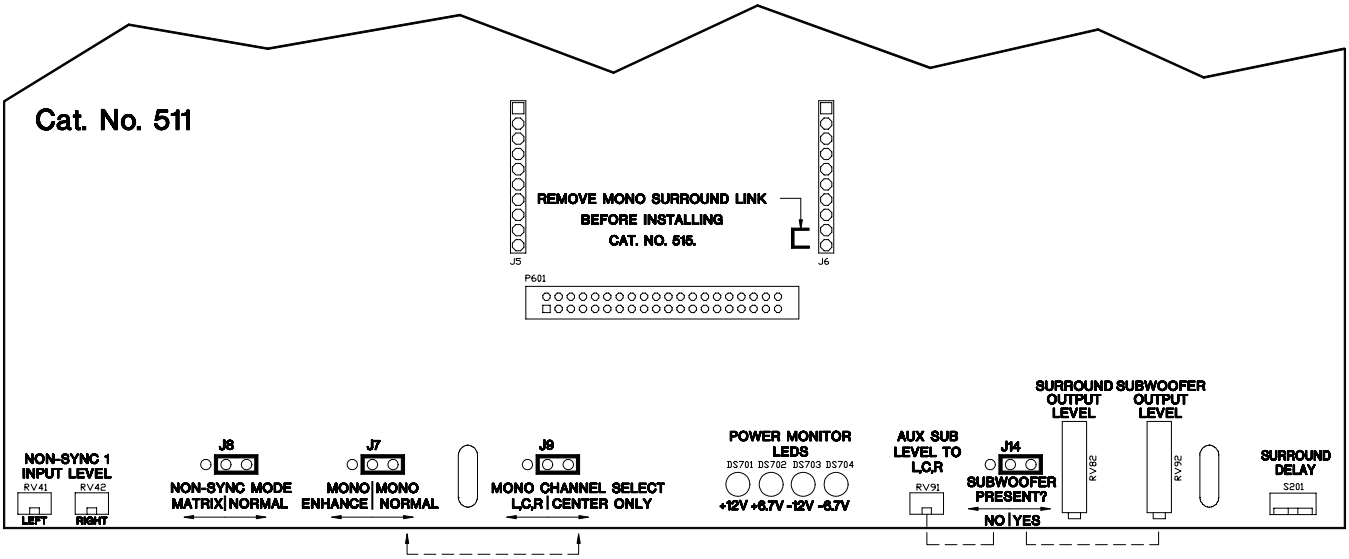
This jumper sets upper frequency limit of the subwoofer channel in optical or non-sync formats to either 50 Hz or 100 Hz. The recommended setting of this jumper depends on the type of screen speakers in your cinema.

If you have the older horn-loaded type of speaker (such as Altec A-4), the jumper should be set to 100 Hz and the equalization for the left, center, and right screen speakers should be rolled off below this frequency. These settings will remove frequencies from the main screen speakers that they cannot accurately reproduce at full power and send them to the subwoofer which is better able to handle them. The factory setting is 100 Hz.

If you have the newer direct-radiator type of screen speakers, set J501 to the 50 Hz position and adjust the equalization of the main screen speakers to roll off below that frequency.

J502 Subwoofer Mute Jumper

This jumper disables the subwoofer channel when it is placed in the MUTE position. The subwoofer channel should be muted during adjustment of the room equalization.



J6 Mono Surround Jumper

This jumper should be installed for mono surround operation. If your cinema is equipped with separate power amplifiers and speaker wiring for left and right surround channels, an optional Cat.No.515 Stereo Surround board is available. This jumper is removed if the Cat.No.515 is installed. Note that stereo surround signals are only available in format 61, Aux.

J8 Non-sync 1 mode

NORMAL Selects standard non-sync processing. The non-sync signals are sent to the left, center and right screen channels, with a mono mix to the surround channel. There is no center or subwoofer output. The CP45 is factory set to this position.

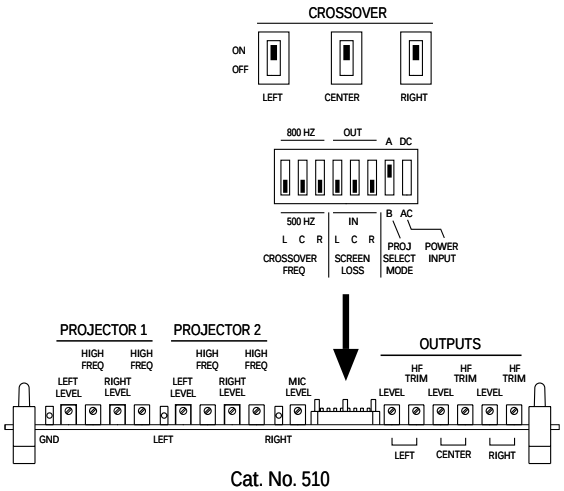
MATRIX Selects full 2:4 matrix decoding of the non-sync signal. The output is sent to the left, center, right, surround and subwoofer channels without noise reduction. This format would be used for playback of video sources.

J7 Mono (format 01) mode

MONO ENHANCE Generates a pseudo-stereo output which tends to enhance mono sources. May be used when large amounts of mono material will be played.

MONO NORMAL Selects normal mono operation on Format 01. The CP45 is factory set to this position.

2.4.4 Cat. No. 510 Switches



Cat. No. 510

Crossover On/Off Switches

ON Enables the crossover circuitry for use with bi-amplified speaker systems connected to the Left, Center, and Right screen channels.

OFF Disables the crossover circuitry. Use this switch position when full-range screen speakers and amplifiers are used for Left, Center, and Right screen channels. The CP45 is factory set to the position.

Crossover Frequency Setting Switches

These switches select the crossover frequency used with bi-amplified speaker systems connected to the Left, Center, and Right screen channels.

800Hz	Should be used for small theaters with small high frequency horns.
500Hz	Should be used for average or large horn speakers.

Screen Loss IN/OUT Switches

IN Enables high frequency boost circuitry to compensate for an average perforated screen.

OUT Disables the boost circuitry. This is the factory setting.

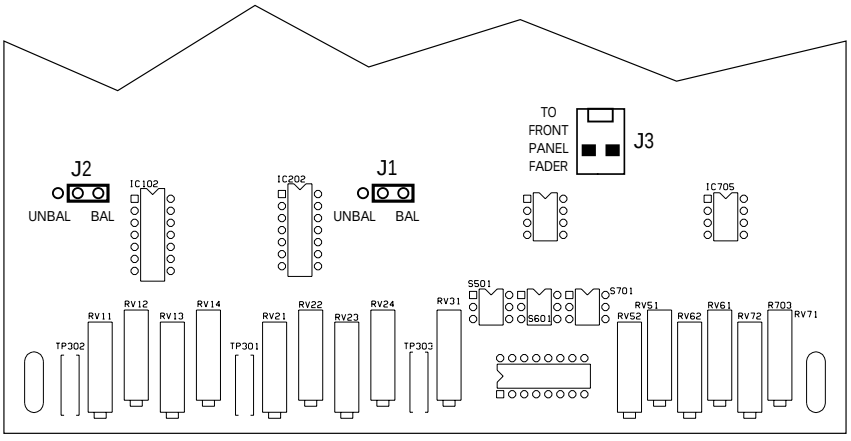
Projector Select Switch

This switch selects which projector input is selected when any external changeover contacts are open.

Power Input Switch

This switch selects which type of mains transformer is used to power the CP45, AC output or DC output. AC is the factory setting.

LED Soundhead amplifier type jumpers J1 and J2



Your projector may be equipped with a Cat. No. 655 LED soundhead. This product has two varieties. One type has a single 8 pin IC on it, the other has two IC's.

Set J1 (projector 1) and/or J2(projector 2) to **UNBALANCED** if the Cat. No. 655 LED soundhead has **ONE** IC. This will raise the gain of the optical preamplifier circuit and ensure correct surround decoding.

Set J1 (projector 1) and/or J2(projector 2) to **BALANCED** if the Cat. No. 655 LED soundhead has **TWO** ICs, or for use with all other types of non-amplified cells.

2.5 Mains Power Wiring

The CP45 is supplied with two mains powered transformers. One is used to power the unit during normal operation and the other is used when the CP45 is switched to BYPASS operation.

If there is any chance that the source of power to the normal transformer might be interrupted, it is very important to feed the bypass transformer from a separate source, preferably through a separate circuit breaker. This way the automatic bypass switchover can take place with the absolute minimum of interruption to the audience.

In some countries the primary cable of each transformer may not have a mains connector fitted. These unterminated leads must be properly wired to a mains connector in accordance with the following international code:

Brown wire	Live or hot
Blue wire	Neutral

NOTE: Neither wire is to be connected to the earth terminal of a three-pin mains plug.

If you are uncertain about the wiring of your mains outlet do not use it. Consult a qualified electrician.

2.6 Connect the Transformers to AC Mains Power

a. With the **NORMAL/BYPASS** switch in the **NORMAL** position, verify that the **BYPASS** indicator is off and any one of the format switch indicator LEDs is on.

b. Select each format in turn, using the buttons on the front panel and check that the associated LED lights. If either format 04 or 05 LEDs do not remain on when their select buttons are released, then the Cat. No.222 card may be loose.

c. Set the **NORMAL/BYPASS** switch to the **BYPASS** position. The bypass indicator on the front panel should blink.

d. Return the **NORMAL/BYPASS** switch back to the **NORMAL** position and apply power to the other projection room equipment.

2.7 Hum Problems

If you hear undesirable hum from the speakers when you apply power to the CP45 and other projection room equipment, check the following list for possible causes:

1. **Ground loops** caused by audio signal wiring, especially to power amplifiers. Be sure to check the booth monitor installation.

2. **Projector power wiring**. All mains wiring should be properly grounded.

3. **Room lighting dimmer controls** (SCR-TYPE).

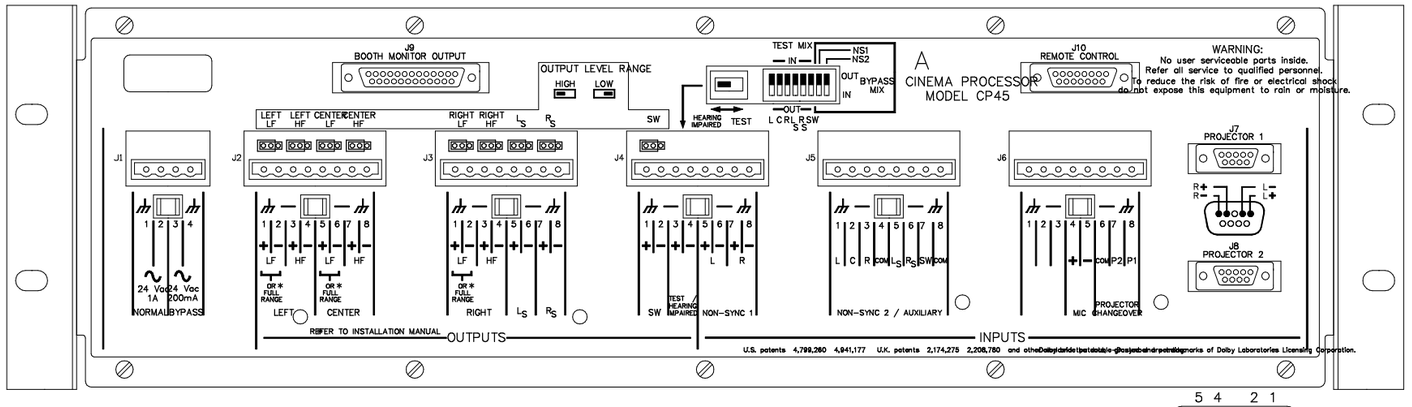
4. **Power amplifiers**. Disconnect from the CP45 and ground the inputs to determine if the power amplifiers are causing hum problems.

With CP45 **FADER** turned up and format 04 selected:

5. **Solar cell wiring**. Check the shield connections. Cell wiring should be placed away from mains and other wiring. Cell wires must not be connected to the frame of the projector.

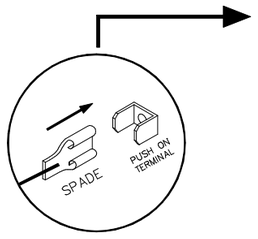
6. **Exciter lamp power supply**. Check for ripple on the DC power supply outputs. Some old exciter lamp power supplies and emergency supplies provide AC to the lamp. The resulting hum makes them totally unsuitable for a Dolby film sound system. Such exciter supplies must be replaced.

7. **Projection room lighting/solar cells**. Ambient lighting, especially florescent tubes, can leak into the solar cell area and cause hum.

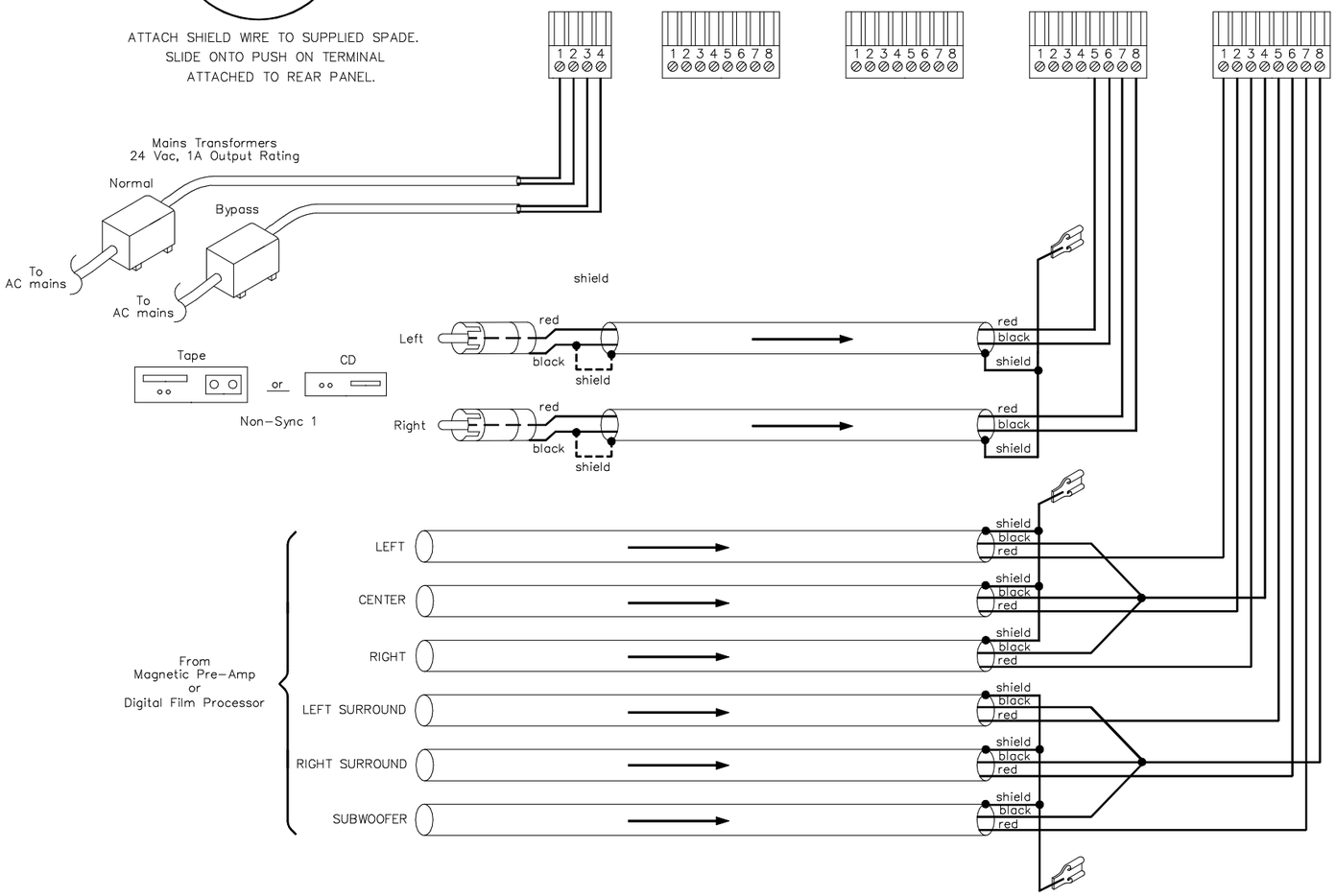


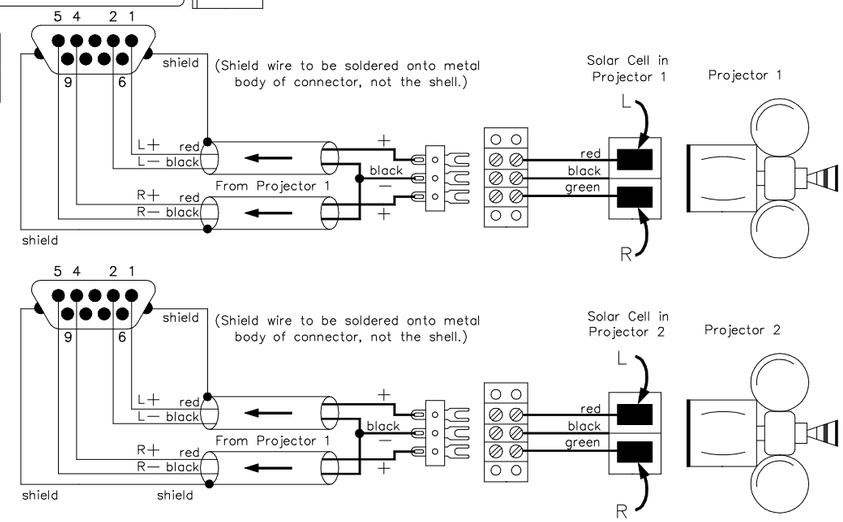
NOTES:

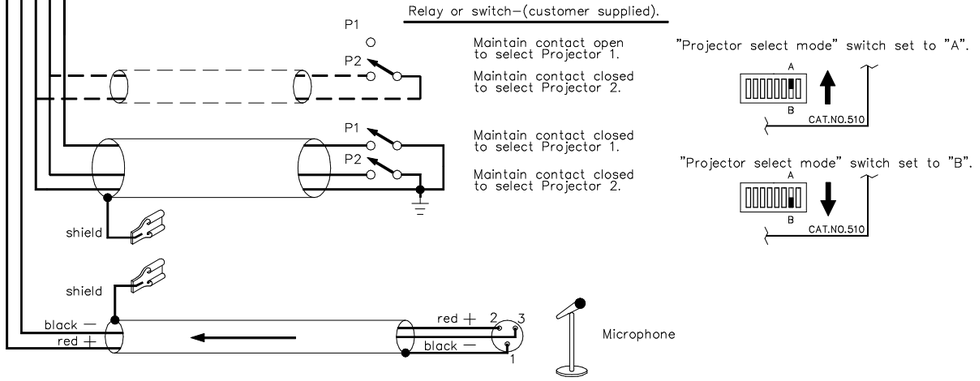
1. Follow all local electrical and building codes.
2. Use earthed (grounded) conduit wherever possible. Avoid routing signal wiring near electric motors, rectifiers, power wiring, dimmer wiring or other sources of electrical noise.
3. Use 2–conductor shielded cables such as Belden 8451 or an equivalent type wire.
4. Some reverse scan readers require a supply common connection to the CP45. Pin 6 of each connector supplies this.



ATTACH SHIELD WIRE TO SUPPLIED SPADE.
SLIDE ONTO PUSH ON TERMINAL
ATTACHED TO REAR PANEL.







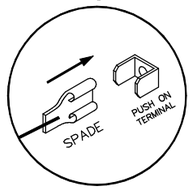
FA437S02 REV 2
ET 4NOV96

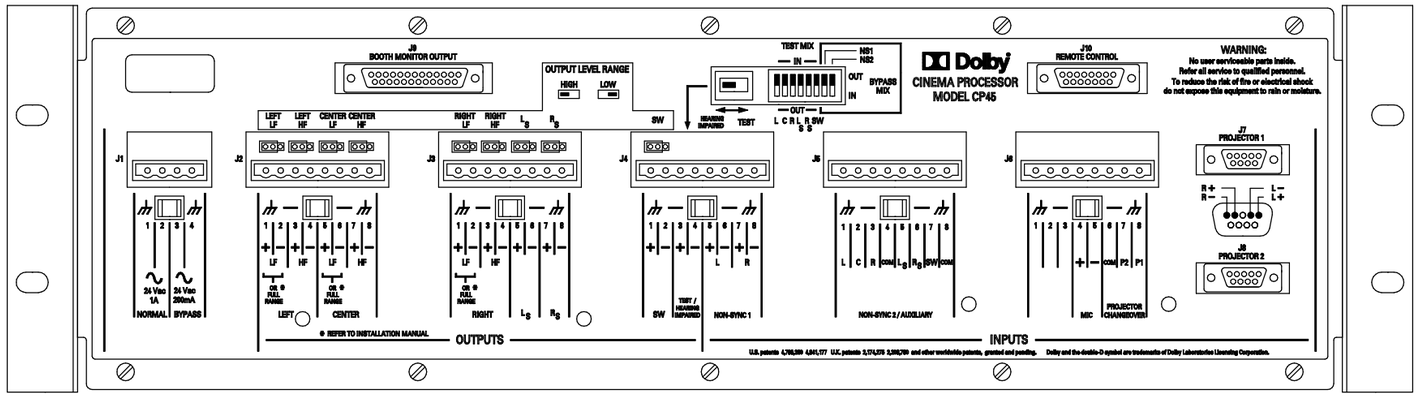
CP45 INSTALLATION WIRING INPUTS

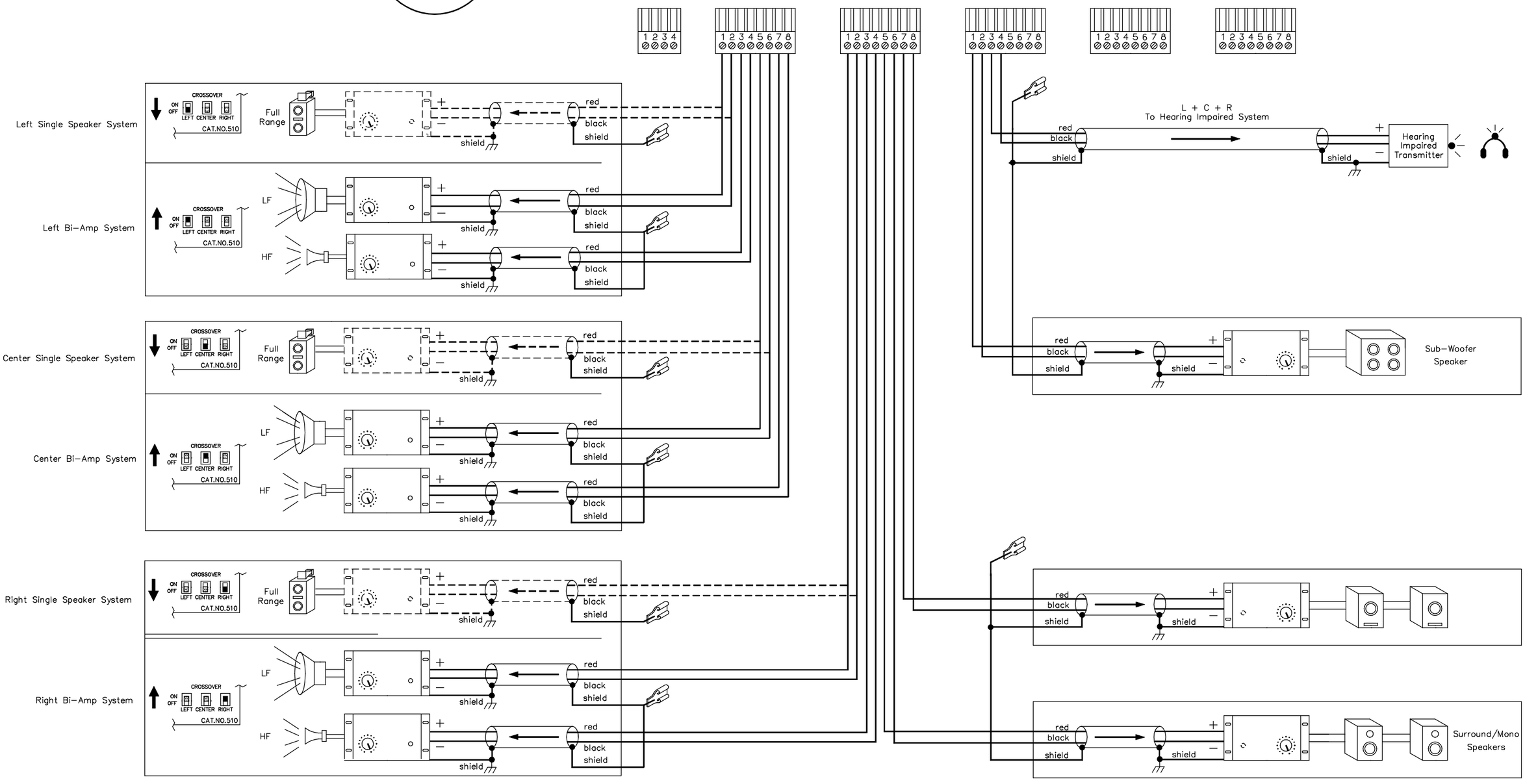
NOTE:

1. FOLLOW ALL LOCAL ELECTRICAL AND BUILDING CODES.
2. USE EARTHED (GROUNDED) CONDUIT WHEREVER POSSIBLE. AVOID ROUTING SIGNAL WIRING NEAR ELECTRIC MOTORS, RECTIFIERS, POWER WIRING, DIMMER WIRING OR OTHER SOURCES OF ELECTRICAL NOISE.
3. USE 2–CONDUCTOR SHIELDED CABLES SUCH AS BELDEN 8451 OR AN EQUIVALENT TYPE WIRE. UNBALANCED INPUT POWER AMPLIFIERS SHOWN. FOR BALANCED INPUT POWER AMPLIFIERS, ENSURE THAT AMPLIFIER COMMONS ARE CONNECTED TO CP45 GROUND, EITHER THROUGH THE RACK OR VIA A WIRE INSTALLED FOR THAT PURPOSE.
4. USE BELDEN 8451 2–CONDUCTOR SHIELDED WIRING FOR ALL SIGNAL WIRING (TWO 22AWG TWISTED PAIR STRANDED CONDUCTORS, TINNED COPPER, FOIL ALUMINUM–POLYESTER SHIELD WITH TINNED COPPER DRAIN RF, 100% SHIELD COVERAGE.

ATTACH SHIELD WIRE TO SUPPLIED SPADE.
SLIDE ONTO PUSH ON TERMINAL ATTACHED TO REAR PANEL.







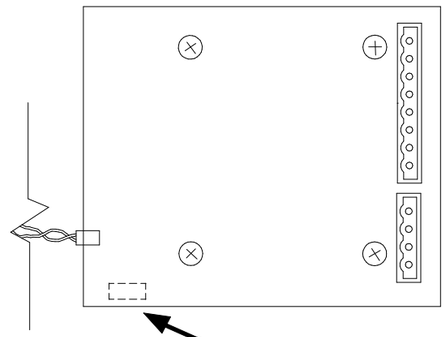
CP45 INSTALLATION WIRING
OUTPUTS

Dolby Cat. No. 516
Remote Unit

Customer supplied cable to
15 pin female D-connector

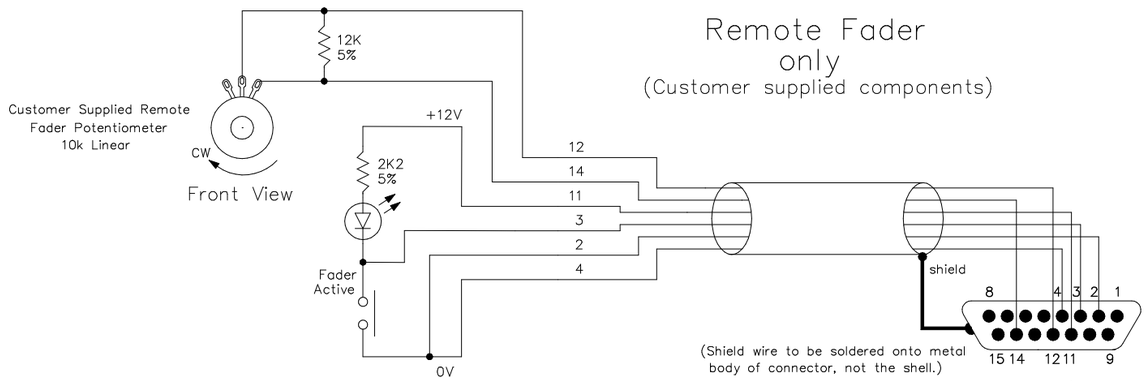
J10 (on CP45 or on Cat. No. 545 Adapter board)

PIN NO.	
11	+12V logic supply
10	Aux/Non-sync 2 command
4	Logic ground
9	Non-sync 1 command
6	Dolby SR command
13	Mute command
5	Dolby A-type command
7	Mono command
12	Remote fader CW terminal
2	Revert to local fader if unplugged
14	Remote fader CCW terminal
3	Activate remote fader command

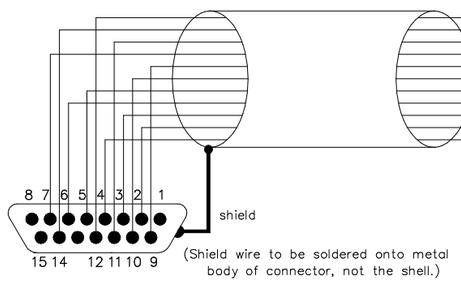


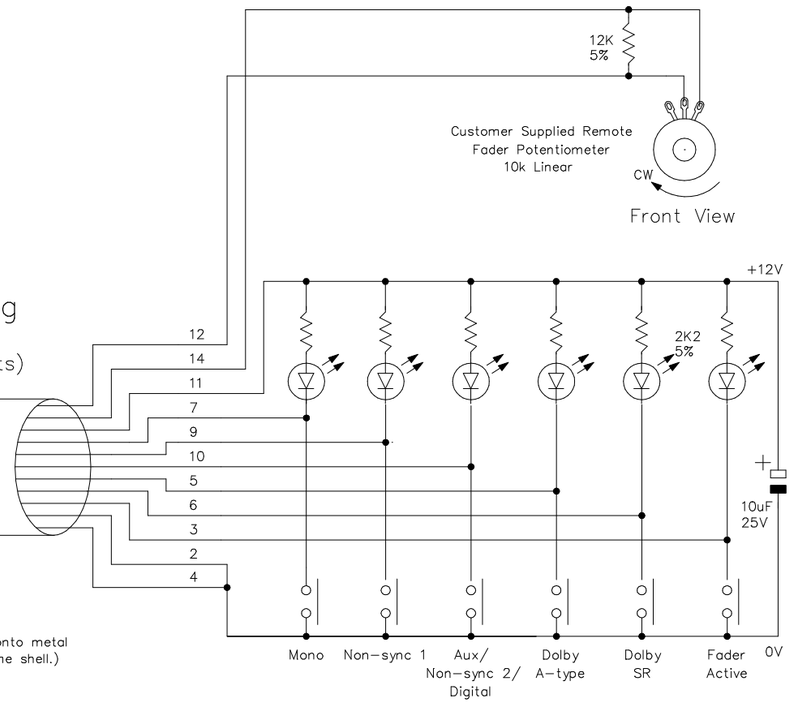
Level Matching Adjust

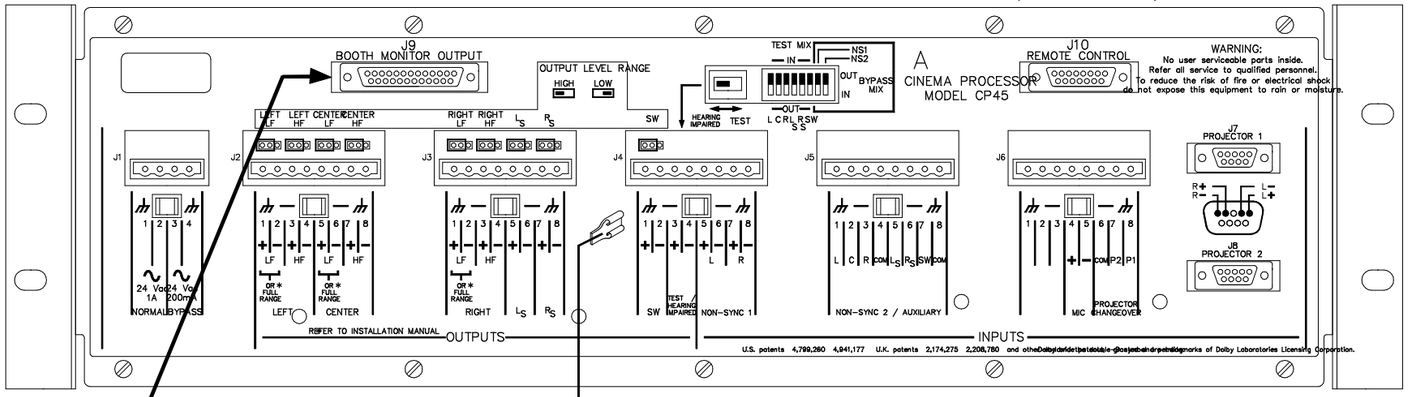
Remote Fader only
(Customer supplied components)



and Format Switching Remote Fader
(Customer supplied components)

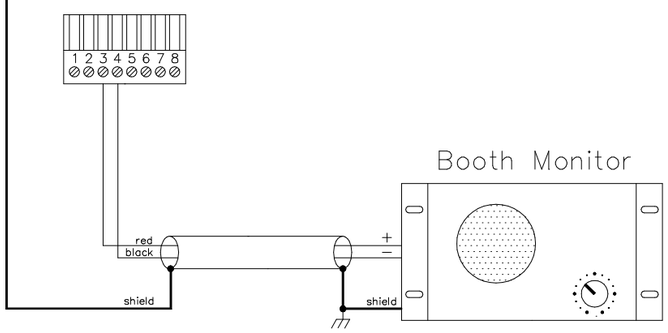






J9 For booth monitor designed specifically for CP45

1	Ground
2	Left LF/Broadband out
3	Ground
4	No connection
5	Center LF/Broadband out
6	Ground
7	No connection
8	Right LF/Broadband out
9	Ground
10	Ground
11	Ground
12	Ground
13	Ground
14	Ground
15	No connection
16	Left HF out
17	Ground
18	No connection
19	Right HF out
20	Ground
21	No connection
22	Center HF out
23	Left Surround out
24	Right Surround out
25	Subwoofer out

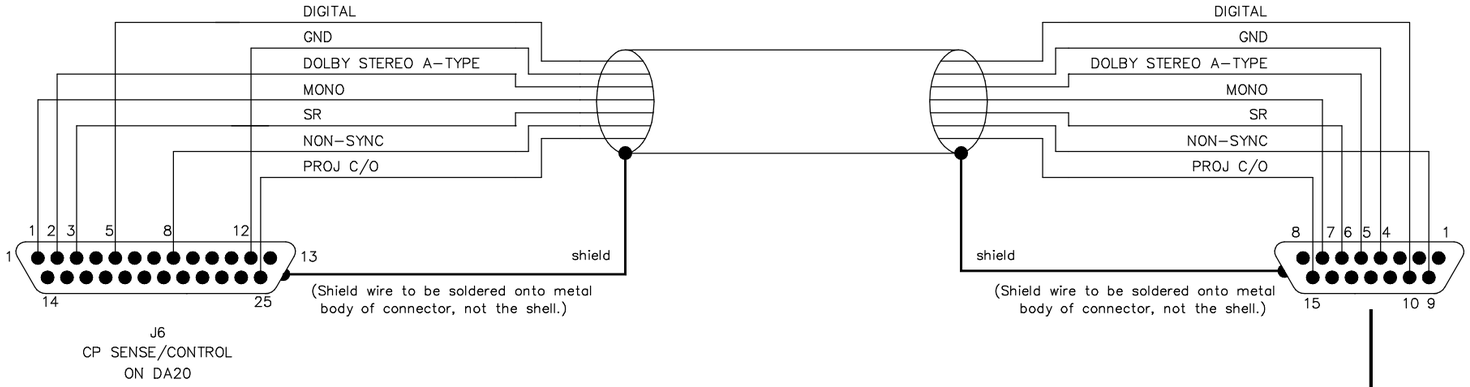


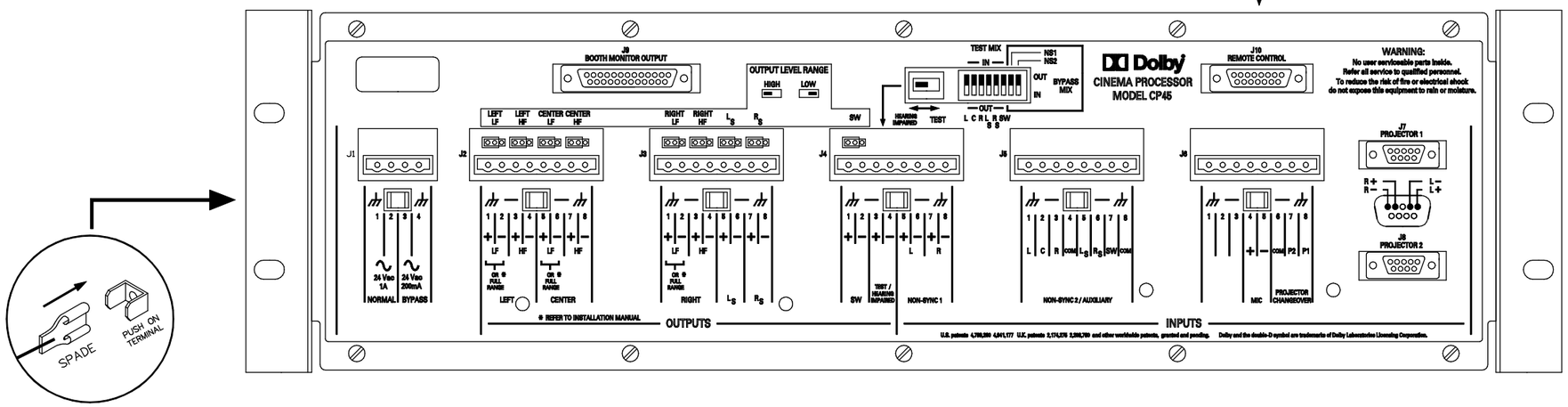
NOTE:

1. Follow all local electrical and building codes.
2. Use earthed (grounded) conduit wherever possible. Avoid routing signal wiring near electric motors, rectifiers, power wiring, dimmer wiring or other sources of electrical noise.
3. For control cable use multi conductor shielded cables such as Belden 9731 or an equivalent type wire.
4. Cat. No. 545 Adapter board is for use in non-EC countries only.
5. Pin 11 on J10 of the CP45 (+12V logic supply) has a series fusible resistor located on the Cat. No. 511. If this line is inadvertently grounded for any length of time, this resistor may open circuit. The LEDs in the remote will not work but the remote itself will continue to function as normal. To replace the resistor, open the front door of the CP45 and locate the large board on the right hand side. Remove power then unlatch and remove the board at the front. The fusible resistor is R604 which is 40MM (1 1/2") away from Pin 1 of the large 48 pin IC. The replacement resistor should be soldered with at least 6MM (1/4") space between the body and the board so that overheating does not damage the board. Carefully replace the Cat. No. 511 board in its socket reapply power and check that the remote LEDs now function. If the resistor burns again check the wiring to the remote connector.

CP45 INSTALLATION WIRING
REMOTE CONTROL/BOOTH MONITOR

FA437T02 REV 2
ET 1NOV96

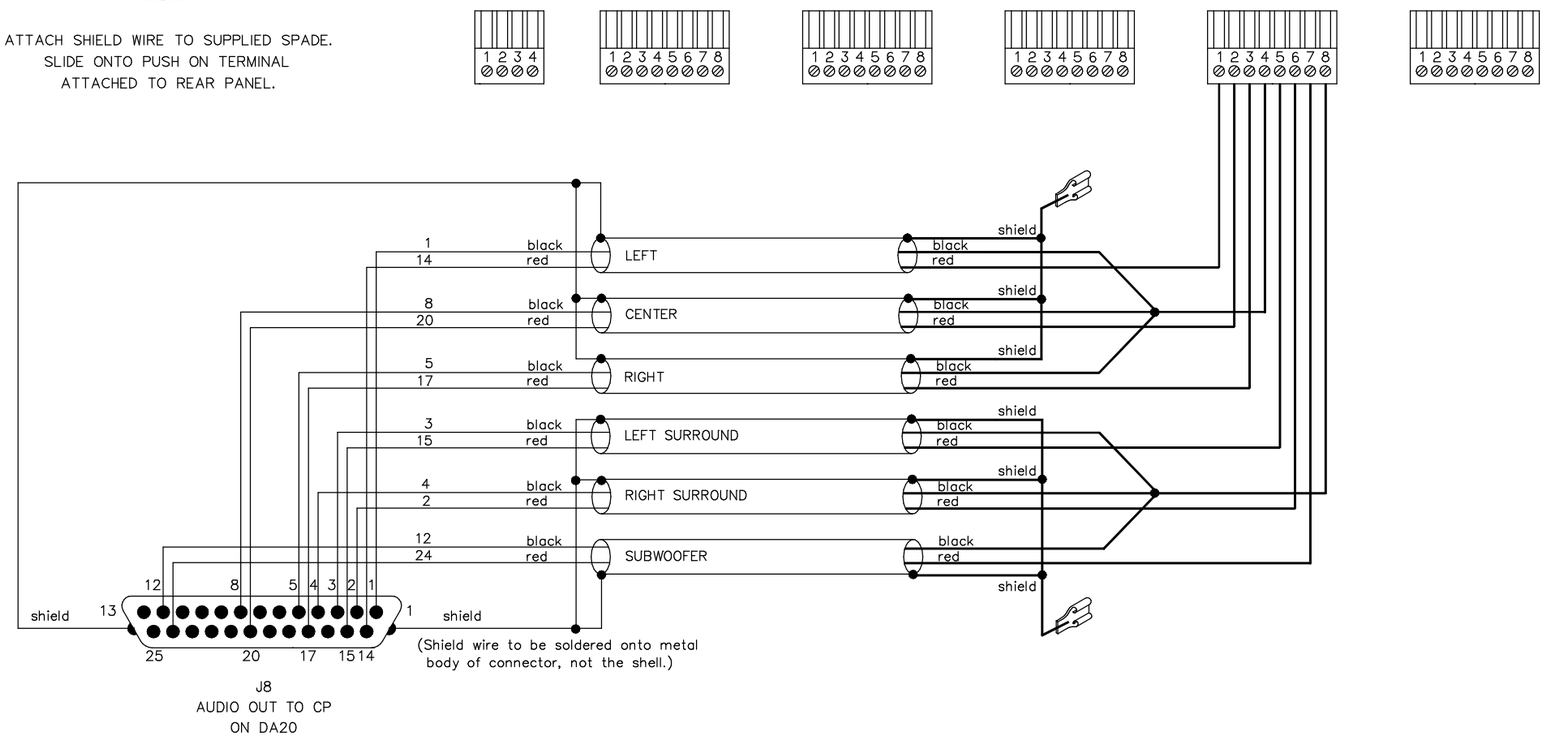




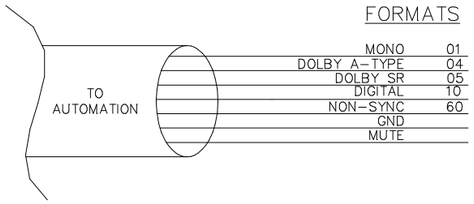
ATTACH SHIELD WIRE TO SUPPLIED SPADE.
SLIDE ONTO PUSH ON TERMINAL
ATTACHED TO REAR PANEL.

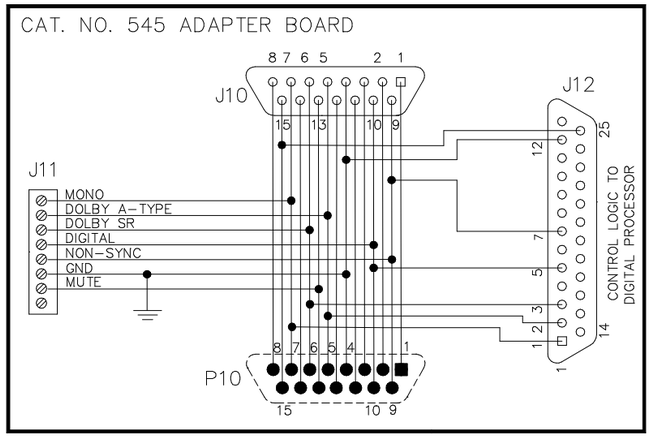
NOTE:

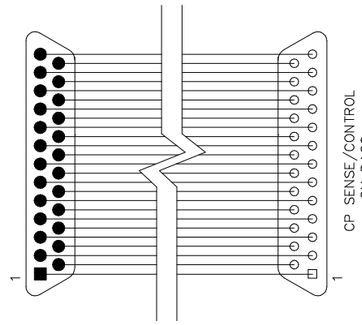
1. FOLLOW ALL LOCAL ELECTRICAL AND BUILDING CODES.
2. USE EARTHED (GROUNDED) CONDUIT WHEREVER POSSIBLE. AVOID ROUTING SIGNAL WIRING NEAR ELECTRIC MOTORS, RECTIFIERS, POWER WIRING, DIMMER WIRING OR OTHER SOURCES OF ELECTRICAL NOISE.
3. FOR SIGNAL INPUT CABLES USE 2–CONDUCTOR SHIELDED CABLES SUCH AS BELDEN 8451 OR AN EQUIVALENT TYPE WIRE.
4. FOR CONTROL CABLE USE MULTI CONDUCTOR SHIELDED CABLES SUCH AS BELDEN 9731 OR AN EQUIVALENT TYPE WIRE.



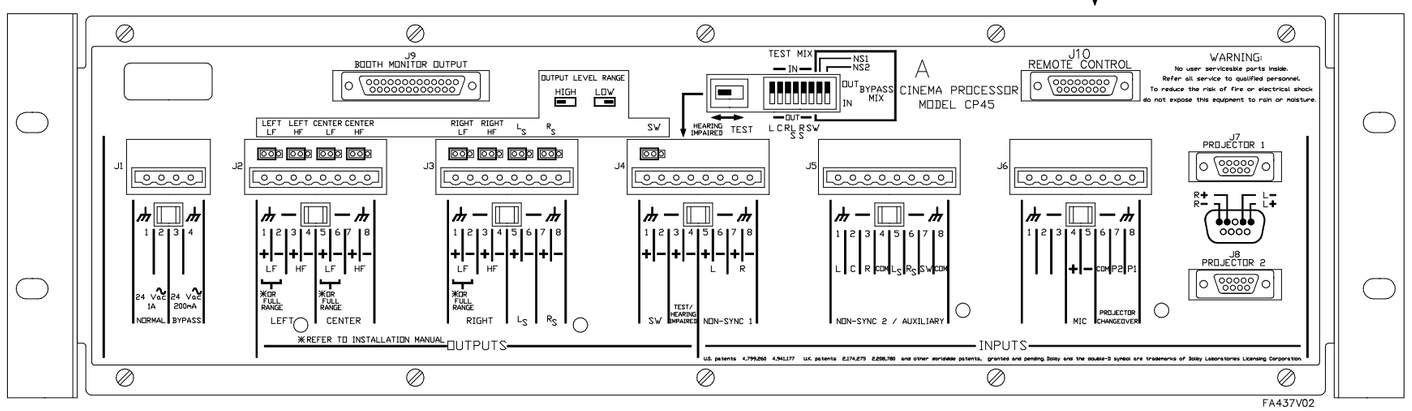
CP45 INSTALLATION WIRING
CONNECTIONS TO DA20, NON–AUTOMATED





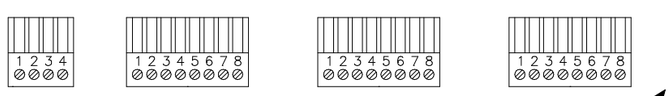


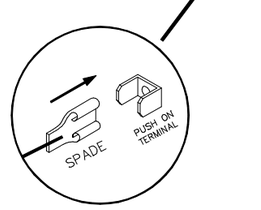
A 20 INCHES (508 MM) CABLE ASSEMBLY
IS AVAILABLE AS
DOLBY PART NO. 83135


J9 BOOTH MONITOR OUTPUT
OUTPUT LEVEL RANGE HIGH LOW
TEST MIX IN NS1 NS2 BYPASS MIX
A CINEMA PROCESSOR MODEL CP45
J10 REMOTE CONTROL
WARNING: No user serviceable parts inside. Refer all service to qualified personnel. To reduce the risk of fire or electrical shock do not expose this equipment to rain or moisture.
HEARING IMPAIRED TEST
J1 J2 J3 J4 J5 J6
J7 PROJECTOR 1
J8 PROJECTOR 2
24 Vac 1A NORMAL
24 Vac 200mA BYPASS
LEFT CENTER RIGHT SW NON-SYNC 1 NON-SYNC 2 / AUXILIARY MIC PROJECTOR CHANGEOVER
REFER TO INSTALLATION MANUAL
OUTPUTS
INPUTS
FA437V02

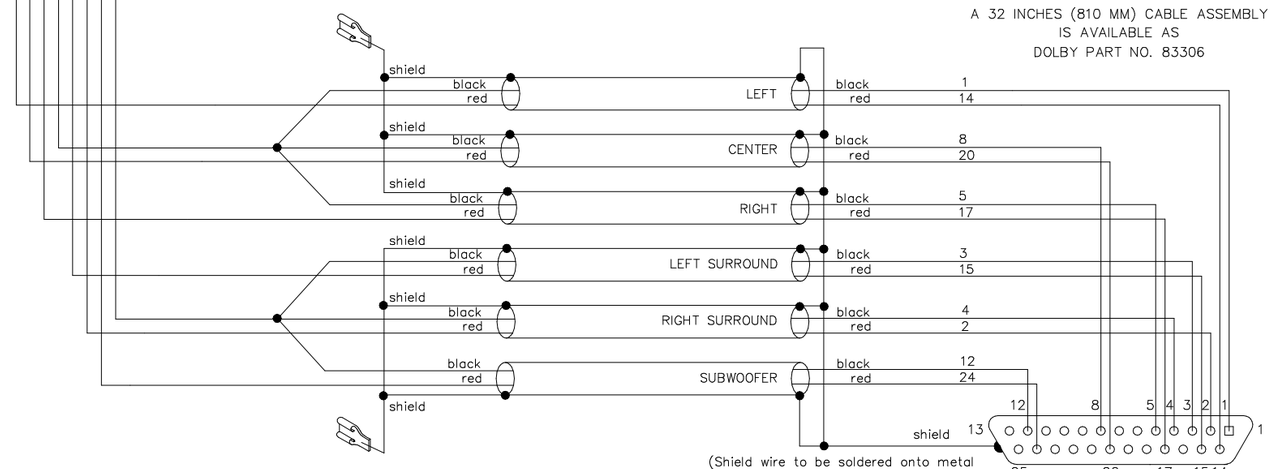
NOTE:

1. Follow all local electrical and building codes.
2. Use earthed (grounded) conduit wherever possible. Avoid routing signal wiring near electric motors, rectifiers, power wiring, dimmer wiring or other sources of electrical noise.
3. For signal cables use 2-conductor shielded cables such as Belden 8451 or an equivalent type wire.
4. For control cable use multi conductor shielded cables such as Belden 9731 or an equivalent type wire.
5. Cat. No. 545 Adapter board is for use in non-EC countries only.
6. Pin 11 on J10 of the CP45 (+12V logic supply) has a series fusible resistor located on the Cat. No. 511. If this line is inadvertently grounded for any length of time, this resistor may open circuit. The LEDs in the remote will not work but the remote itself will continue to function as normal. To replace the resistor, open the front door of the CP45 and locate the large board on the right hand side. Remove power then unlatch and remove the board at the front. The fusible resistor is R604 which is 40MM (1 1/2") away from Pin 1 of the large 48 pin IC. The replacement resistor should be soldered with at least 6MM (1/4") space between the body and the board so that overheating does not damage the board. Carefully replace the Cat. No. 511 board in its socket reapply power and check that the remote LEDs now function. If the resistor burns again check the wiring to the remote connector.





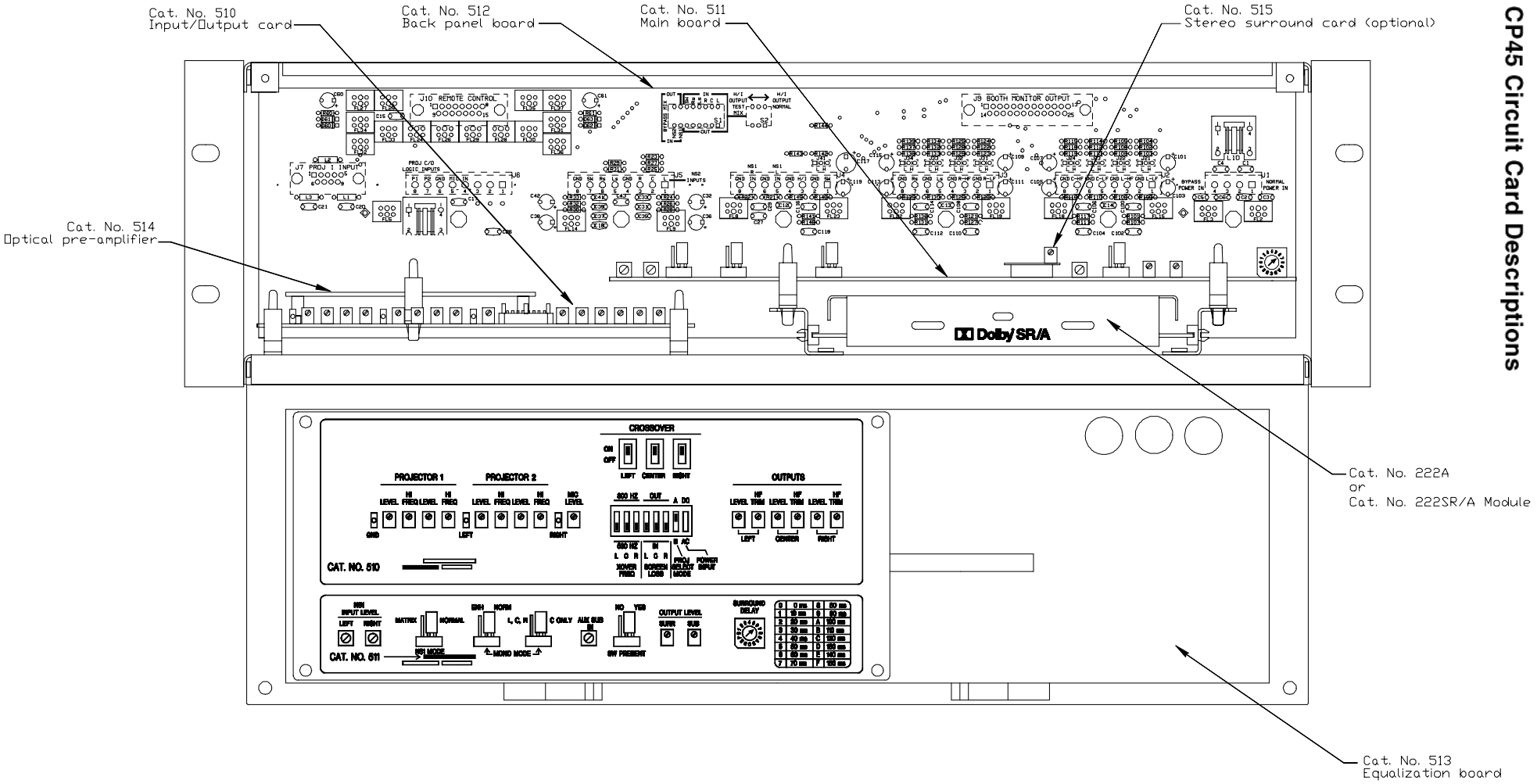
ATTACH SHIELD WIRE TO SUPPLIED SPADE.
SLIDE ONTO PUSH ON TERMINAL
ATTACHED TO REAR PANEL.



A 32 INCHES (810 MM) CABLE ASSEMBLY
IS AVAILABLE AS
DOLBY PART NO. 83306

CP45 INSTALLATION WIRING CONNECTIONS TO DA20 AND/OR AUTOMATION

PART NO. 91450



Interior view of CP45, showing modules installed

Cat. No. 510/514 Input/Output Card

The Cat. No. 510 is the input and output part of the CP45. It has two stereo inputs for optical soundtracks, one mono microphone input, and six outputs for the front screen speakers. The card is normally fitted with a Cat. No. 514 optical preamplifier card which converts the solar cell signals from the projectors into voltages which are handled by the Cat. No. 510. Gain and equalization for projector slit loss and microphone gain are set by controls on the card.

The card is normally powered by the bypass transformer if this is present, otherwise it takes its power from the main power supply circuitry in the unit. The bypass supply regulator consists of a very simple zener regulator and ground reference circuit which uses the minimum of components for very high reliability.

The front screen speaker outputs are switchable to be full-range or four pole Linkwitz Reilley active crossovers. Each output has a boost circuit which is designed to compensate for an average perforated screen with the mouth of the HF horn within one inch of the rear surface. If the unit is used with speakers which for reasons of space are not mounted behind the screen or already contain the HF boost, the peaking can be switched off on each channel individually.

The microphone input has a sensitivity high enough for use with average low impedance moving coil capsules.

The power amplifier output stages each have a level adjustment to cater for a very wide range of amplifier sensitivities and the HF outputs can each be adjusted to cope with the greater efficiency of horn-loaded loudspeakers.

The potentiometers have transparent cases to make adjusting a replacement easy.

Cat. No. 511 Main Board

The Cat. No. 511 main board carries all the circuitry for decoding Dolby A-Type and SR encoded film soundtracks. The unit also carries a wide range switching power supply which converts a low voltage AC supply from an external transformer into the various voltages used in the unit.

The board has all the logic switching for the various modes and carries the electronic volume control circuits for most of the outputs. In use, if there is any malfunction such as a power rail going out-of-range or a connection not being properly made, the main board will signal to the Cat. No. 510 input/output board that there is a fault and will then be completely removed from the signal path.

There is also a pair of inputs which can be connected video projectors etc. and which feed the Dolby decoder. This input can also be used for background and intermission music.

The board also carries the driver circuitry for the Cat. No. 222A or Cat. No. 222SR/A modules and the audio delay circuit for the surround channel.

The Low frequency content of the front screen speaker signals is separated and sent to a special output stage to drive a subwoofer if required. If this signal is derived from optical sources, then it passes thought a sliding band downward expander circuit which suppresses very low frequency interference which can result from poor handling of the film.

If the unit is to be used with a large amount of mono material, there is a circuit which generates a pseudo-stereo output which tends to liven up such sources and enhance the reproduction of music. This mode is selected by a jumper on the main board.

Cat. No. 513 Equalization Board

The Cat. No. 513 board carries all the house equalizer controls for adjusting the room response of the theater. There are seven 2/3 octave bands which cover the frequencies which cause most difficulty in loudspeaker systems. The bass and treble boost and cut controls are parametric with adjustable turnover frequencies to compensate for both the rate at which response tends to rise or fall and the corner frequency where the tendency starts.

There are also simple three band surround equalizer sections and a two pole filter for the subwoofer channel.

The main activity indicators are also on the front panel so that signal activity on each channel can be checked.

The rest of the card is taken up with the controls for selecting the format of the film to be shown or for selecting background music, etc.

Cat. No. 515 Stereo Surround Card (Optional)

The Cat. No. 515 is a small board that is mounted on the Cat. No. 511 main board when stereo surround operation is desired. It has voltage controlled amplifiers and switching logic which control the source of the stereo surround signal feed. In Formats 4 and 5, the source is the motion picture matrix decoder on the main board, when format 60 (AUX) is selected, the source is the right surround input on the rear of the unit. When the board is not fitted, the surround source is a 1:1 mix

of left and right surround inputs. In order to get this mix, there is a jumper on the right hand side connector which must be placed as shown on the board.

Cat. No. 222A Module

This module provides two channels of Dolby A-type noise reduction for the soundtracks.

Cat. No. 222SR/A Module

This module provides two channels of either Dolby A-type noise reduction or Dolby SR processing for the soundtracks.

Cat. No. 516 Remote Unit

The Cat. No. 516 is a small remote unit which allows selection of the film format and playback level from a point near the projectors. The connection to the CP45 is via a 15-way screened cable which may share the remote output on the CP45 with an automation system if installed.

FORMAT 01
For mono optical soundtracks.

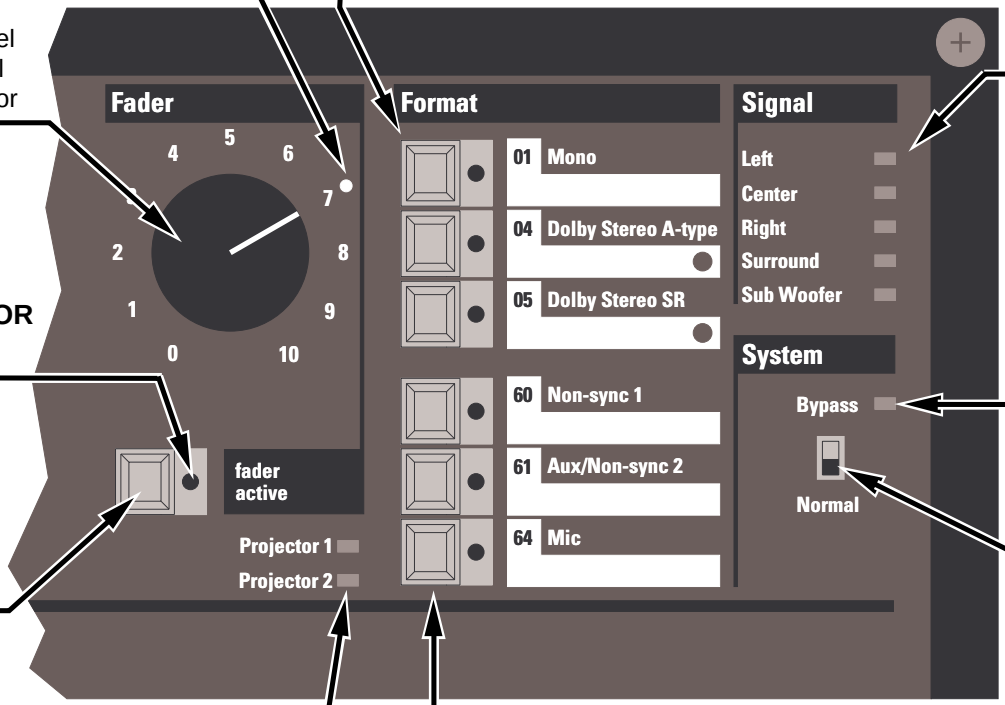
FORMAT 04
For Dolby Stereo soundtracks except those marked SR or SR•D.

FORMAT 05
For Dolby Stereo SR soundtracks.

Normal fader setting.

FRONT PANEL FADER
Controls the auditorium level when selected. The control should be set at or near 7 for normal operation.

SIGNAL PRESENCE INDICATORS
These will light if a signal is present on the indicated channel.



FADER ACTIVE INDICATOR
Shows if the front panel fader has been selected.

BYPASS INDICATOR
Flashes if the CP45 is in **bypass** mode. The CP45 will automatically switch to **bypass** if the internal power supply fails.

FADER ACTIVE BUTTON
Switches the fader control back to local (this fader) if remote faders are installed.

BYPASS/NORMAL SWITCH
For manually switching to **bypass** if there is a problem. Switches to a separate power supply.

PROJ 1/PROJ 2 INDICATORS
Show which projector has been selected.

FORMAT 60
For **non-sync**, background music from a cassette deck or CD player.

FORMAT 61
For extra sound sources.

FORMAT 64
Selects the microphone for public announcements. If the CP45 is in **bypass** mode, **push and hold** this button to make an announcement.

CP45 Front Panel Controls

SECTION 3
AN OVERVIEW OF THE ALIGNMENT PROCEDURE

This section is an overview of the general principles involved in the alignment of Dolby cinema equipment. It is useful to develop an understanding of why the CP45 is aligned as described in this manual. If the installer is already familiar with these principles, or is in a hurry to complete the installation, this section may be read later. Continue the installation procedure beginning with Section 4.

3.1 Aligning the A-Chain

The A-Chain optics is first cleaned and mechanically adjusted, then calibrated by use of the Cat. No. 69T Dolby Tone test film. This film is used to establish the correct Dolby operating level within the CP45.

Pink noise is used for equalization of the A-chain. (Pink noise is similar to white noise but provides equal energy per octave of bandwidth.)

The optical slit is the key element in the A-chain because it imposes the initial limitation on the high-frequency response of the system. Light from the exciter lamp passes through the optical slit and is focused on the optical soundtracks on the film. The light that passes through the soundtracks falls on the stereo solar cell which generates an electrical signal proportional to the audio signal recorded on the optical soundtracks. The slit introduces high frequency loss which must be compensated by circuitry in the Cat. No. 510 Input/Output card.

The slit image must be correctly focused on the film and must be precisely at right angles to the direction of film movement in order to maintain the correct phase relationships between the two optical tracks. Any azimuth error will show as a loss of high frequency in the front channels and potentially excessive crosstalk in the surround channels.

Each channel in the Cat. No. 510 Input/Output card is equipped with a slit loss equalizer control. Adjustment of this control shifts a fixed amount of boost upward or downward in frequency, but the shape of the curve remains constant. A flat response up to a minimum of 12 kHz can be achieved.

3.2 Aligning the B-Chain

In most theater playback systems, the acoustical qualities of the theater are difficult to change. Therefore, the primary area where improvement is possible is correcting system response errors caused by the theater acoustic environment.

It is not practical for the entire cinema industry to standardize on a single make and model of loudspeaker. In any event, the different acoustical characteristics of individual theaters would, to some extent, negate any such standardized speakers. Electronic equalization of each loudspeaker system achieves consistent results in a broad spectrum of environments, and with a broad range of speakers. Accurate equalization requires the use of standardized acoustic measurement procedures.

A pink noise generator provides a continuous random noise signal that covers the total bandwidth and is used to measure and adjust the response of the loudspeakers. The use of random noise eliminates the problems inherent with tones (standing wave patterns in the theaters) and enables the frequency response of the entire system to be observed. Each channel can be measured and adjusted independently of the other channels.

A calibrated microphone (or a multi-microphone setup with multiplexer) is placed in the auditorium to receive the pink noise reproduced by the loudspeaker. The output of the selected microphone is fed to a real time analyzer (RTA). The RTA displays the audio spectrum received by the microphone in the form of a frequency response curve. Pure pink noise would yield a "flat" horizontal line on the RTA. Thus, the effect of adjustments to the CP45 equalizers is quickly and easily seen.

One of the problems inherent in equalization is the nature of the environment. In an open space, a perfect loudspeaker, radiating a perfectly flat response in all directions, placed in front of a perfectly flat microphone, producing perfectly flat response to sounds arriving from all directions, will display a perfectly flat response on the RTA from pink noise. In an enclosed space such as a theater, the results are different. When the pink noise generator is first turned on, all of the sound that initially reaches the microphone comes directly from the loudspeaker; the response is flat–for a few milliseconds. Then reflected sound from the walls, ceiling, floor, seats, etc. starts to arrive at the microphone together with the direct sound from the loudspeaker. This indirect or reflected sound reinforces the direct sound. The system soon settles into an equilibrium condition. As much energy is being absorbed at the walls, ceiling, etc. as is fed into the room. Since high and mid frequency energy is absorbed when sound is reflected, the displayed response appears to have a rising bass and a falling treble characteristic. At first glance, rolling off the bass and boosting the high frequencies may appear to be the logical approach for a flat steady-state response, but such an arrangement works only on sustained sounds. Dialogue contains short, impulsive sounds and will yield a much-too-bright result because there is no time for reverberation to build and add to the original sound. What is required is a curve that favors such impulsive "first arrival" sound and implies the same gently falling response that is observed when the output of an ideal loudspeaker is measured with a perfect microphone in the theater.

The amount of reverberation varies with frequency and the higher the frequency the more the treble will be absorbed rather than being reflected. A typical reverberation curve in a theater rolls off at about 3 dB per octave above 2 kHz. This characteristic is used to define the standard steady-state response curve for all dubbing theaters in which films with Dolby soundtracks are mixed and for all Dolby processor-equipped cinemas.

The size of the theater affects the reverberation time and, therefore, the measurement of frequency response. After alignment to this standard curve, some slight adjustment of high frequency slope may be found necessary for extremely large or small theaters. The Treble Control located on the Cat. No. 513 can be used to reduce the output on the response curve by approximately 1 dB at 8 kHz for very large theaters; an increase of 1 dB at 8 kHz may be in order for a very small theater. Any such adjustment should be based on an evaluation by ear of actual known films rather than as a rule of thumb.

Some loudspeakers used in theaters are far from ideal and require boosting of the low- and high-frequency extremes in order to produce an approximation of the standard reference response curve. Bass and treble controls—centered on the turnover points of typical loudspeakers—lift the ends of the spectrum without the need for large amounts of narrow-band boost from the EQ circuitry.

The final factor is masking of the screen. Most films today are shown in a wide-screen format. The masking curtains of the screen must be drawn back sufficiently to clear the left and right speakers before any adjustments or measurements are made. The treble horns should clear the screen frame and be mounted as close as possible to the screen. Conventional black felt side masking can severely curtail high frequency response. Consequently, there would be severe losses if the left and right loudspeakers were equalized with the masking open as for a 2.35:1 film, and then the masking were brought in for a 1.85:1 film, thus obscuring the outer speakers. To avoid this problem, some theaters have installed acoustically transparent masking cloth, and others leave the masking open whenever they are showing a 1.85:1 film with a stereo soundtrack. Moving the speakers towards the center of the screen so as to clear heavy masking is not a good solution, since the stereo separation would be degraded.

Repainted screens cannot be used for quality sound playback, since the perforations which allow the high frequencies through the screen can become clogged with paint.

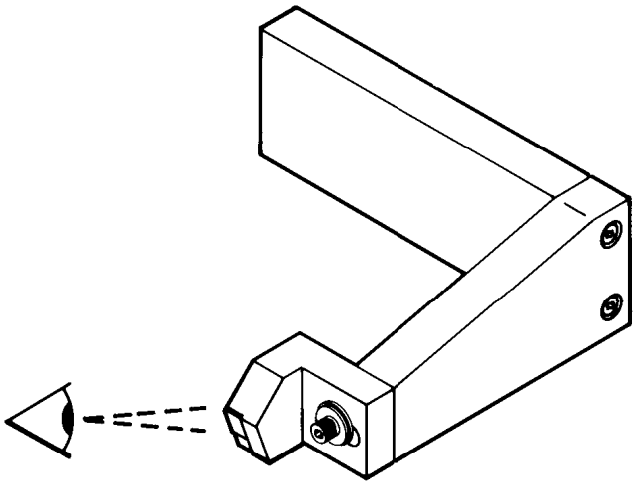
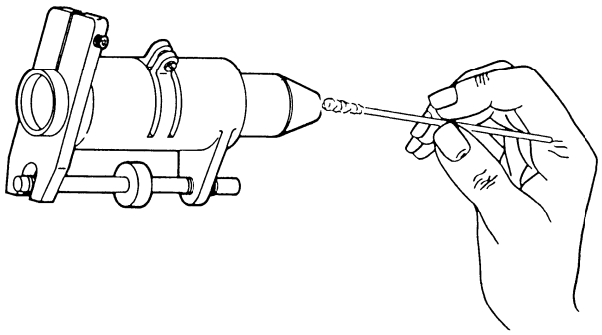
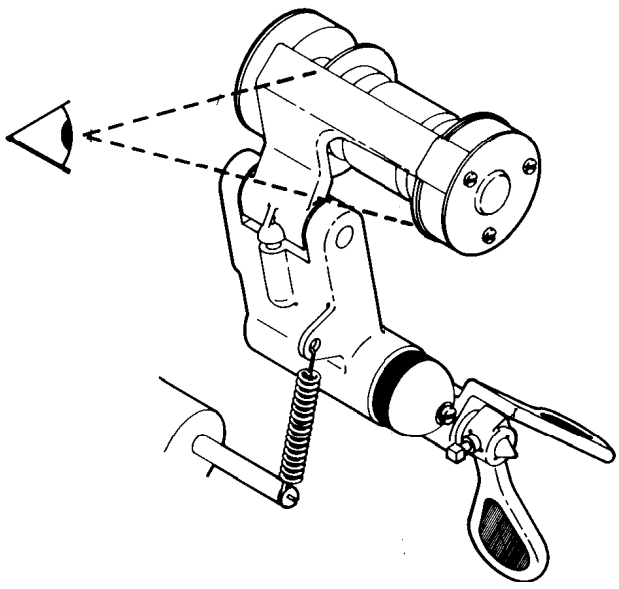
SECTION 4
A-CHAIN ALIGNMENT

The A-chain is the part of the sound system that covers the film path, solar cell, optical preamplifier, slit loss equalizer and Dolby processing circuit.

The CP45 does not contain a magnetic A-chain but has facilities for switching external magnetic preamplifiers into the B-chain via the Aux inputs. These inputs may also be used for connecting digital film sound processors such as the Dolby Model DA20.

A-Chain Alignment Procedures

a. Preliminary Procedures

Step No.	Action	Indication
1		
2		
3		

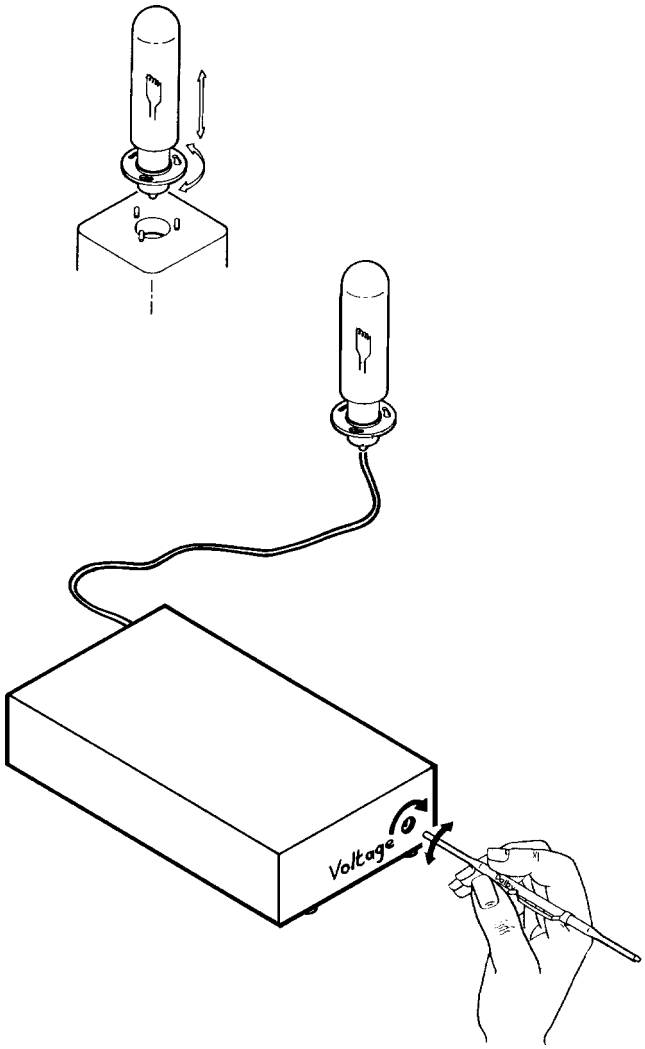
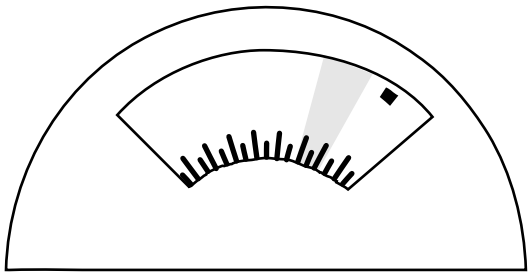
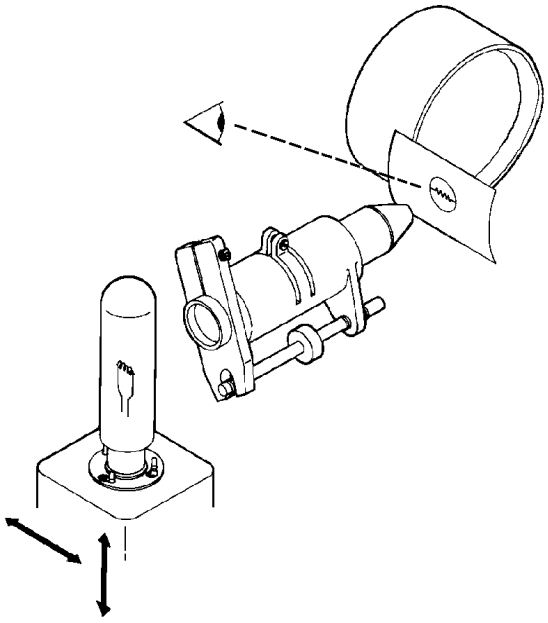
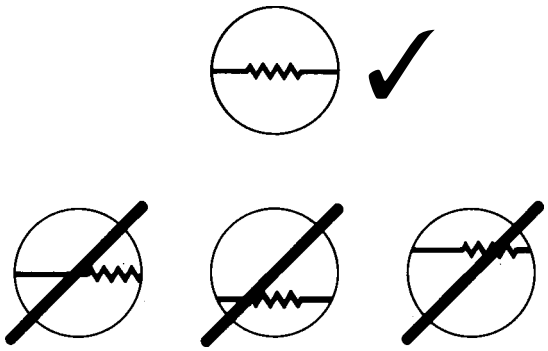
A-Chain Alignment Procedures

a. Preliminary Procedures

Notes
If a stereo solar cell is already installed on Projector No. 1, inspect the surface of the cell for cracks, chipping, or other damage. If the cell appears to require replacement, remove the mounting bracket from the projector and replace the cell and mounting block assembly.
Clean the lens surfaces with a cotton swab moistened with glass cleaner. But keep in mind that you may find during optical preamplifier adjustment, that it will be necessary to remove and inspect the lens if the high-frequency response is not correct. If the lens is removed, clean the lens as indicated above and look through the lens at a bright light. Repeated alternate heating and cooling of the lens can cause oil or other contaminants to enter the lens barrel. Verify that there is a clear, unobstructed light path through the lens and that the edges of the slit are sharp without cracks or corrosion. Fit a new lens assembly if you are unable to clear the optical path through the slit.
Inspect the lateral film guides for evidence of cuts, cracks, surface defects, and any foreign materials that could impair the film guiding. Clean as required or replace the guides, as necessary. Make sure the guide roller rotates freely and, if it is spring mounted, make sure that lateral movement and return is not obstructed. If the roller has a felt or rubber insert, check for a flat spot and replace the roller if necessary.

A-Chain Alignment Procedures

a. Preliminary Procedures

Step No.	Action	Indication
4		**70 TO 80% OF RATED VOLTAGE** 
5		

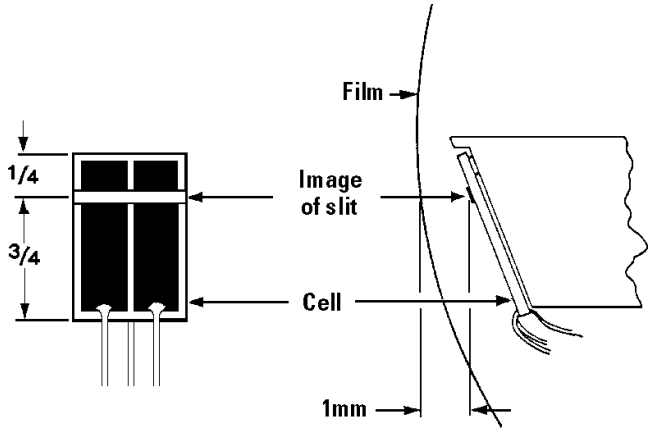
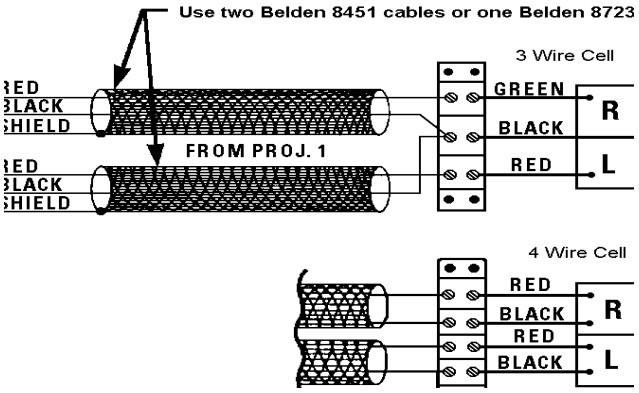
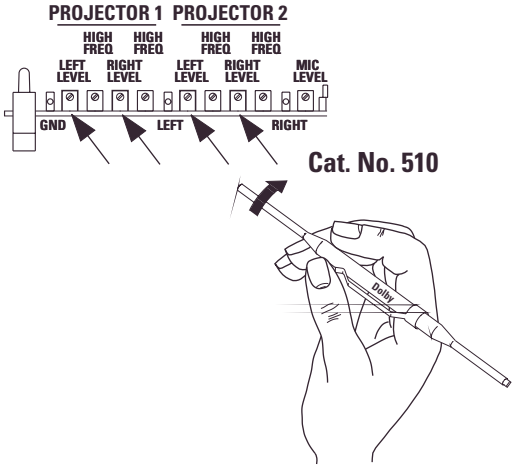
A-Chain Alignment Procedures

a. Preliminary Procedures

Notes
Remove the existing exciter lamp and replace with a new lamp. Adjust the exciter lamp DC voltage to 70% to 85% of the rated voltage and verify that there is no more than 3% ripple present with the lamp on, using an AC millivolt meter or oscilloscope. **LAMP VOLTAGE** — **DC ADJUSTMENT** 6 V — 4-5 volts 9 V — 6.5-8 volts If the projector uses a plastic light pipe or tube, verify that the light output is not appreciably affected by dirt, cracks or flaws, yellowing, or foreign matter. Replace if necessary.
Place a white card at the front of the lens, close to the position of the film soundtrack. Then adjust the position of the exciter lamp until the image of the filament is centered both vertically and horizontally as shown. You may find that obtaining an image of the filament is difficult in some projectors. Place a piece of tissue paper over the lens to assist in seeing the image of the filament. Some projectors do not use adjusting screws to change the position of the lamp; shims are sometimes used for positioning.

A-Chain Alignment Procedures

b. Optical Preamplifier Adjustments

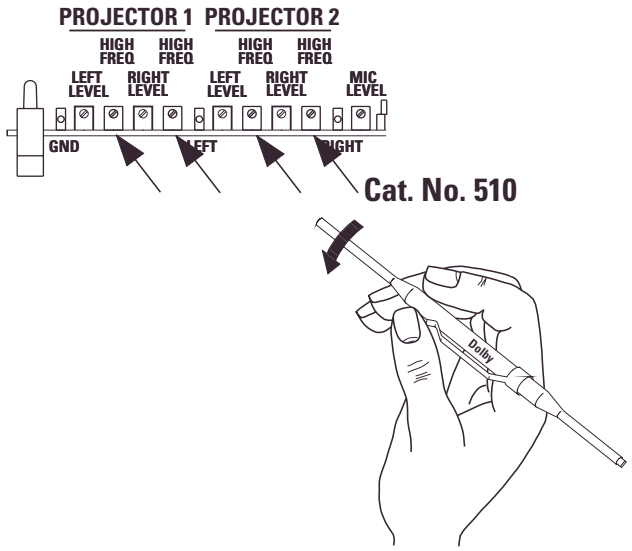
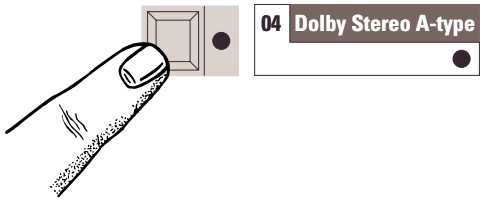
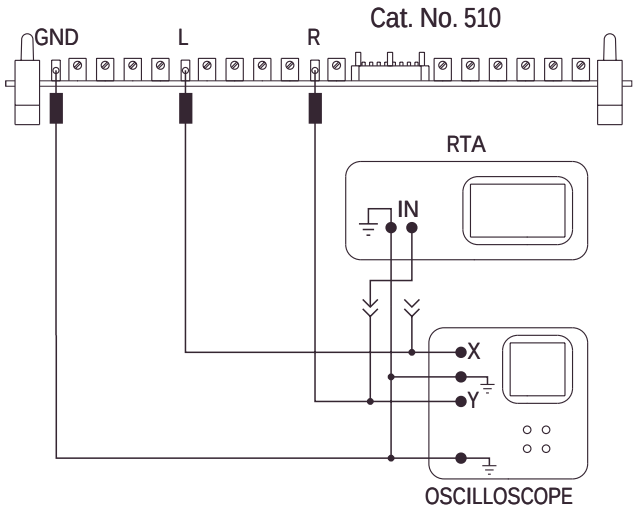
Step No.	Action	Indication
1		
2		
3		

b. Optical Preamplifier Adjustments

Notes
Loosely install the stereo solar cell bracket on the projector. Position the bracket carefully until the surface of the cell is 1 mm from the film plane surface. Note that if this distance is exceeded, there will be crosstalk between the two optical stereo tracks. Check the image of the slit on the cell. The image should be a thin sharp line. The slit image should be as long as the cell, and positioned three-quarters of the way up the cell. Try to get the best compromise among all of these conditions and then tighten the cell bracket mounting screws.
Confirm that the cell wiring and connections are correct. Shielded cables must be used. The inner conductors must be wired to the CP45 PROJECTOR input connectors exactly as shown on the wiring diagram fold-out. **Note: The solar cell associated with the right channel is closest to the edge of the film.**
On the Cat. No. 510 card Turn all of the **Proj 1** and **Proj 2** level potentiometers fully clockwise (CW).

A-Chain Alignment Procedures

b. Optical Preamplifier Adjustments

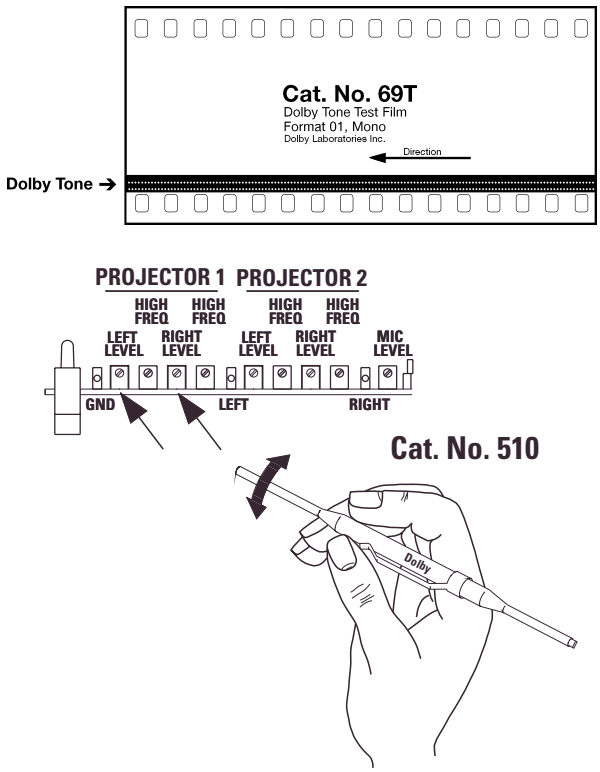
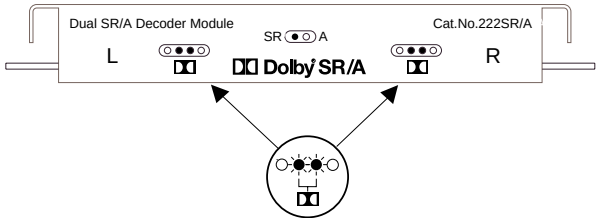
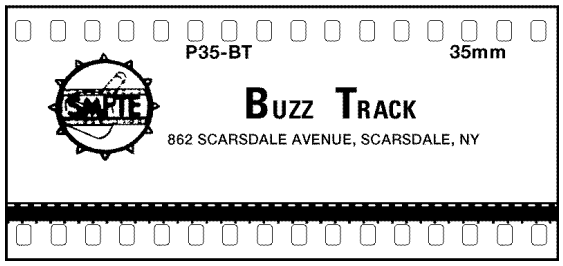
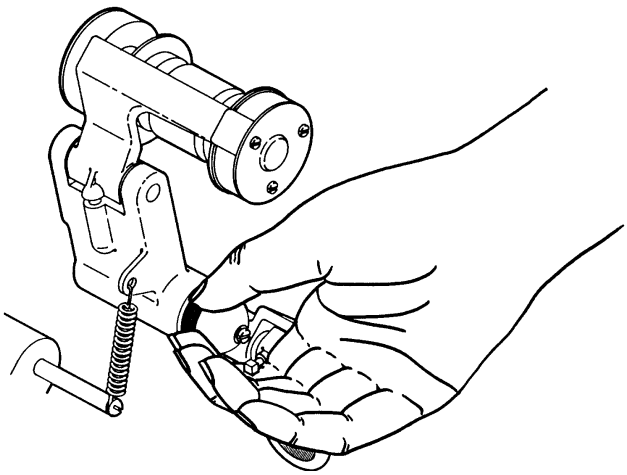
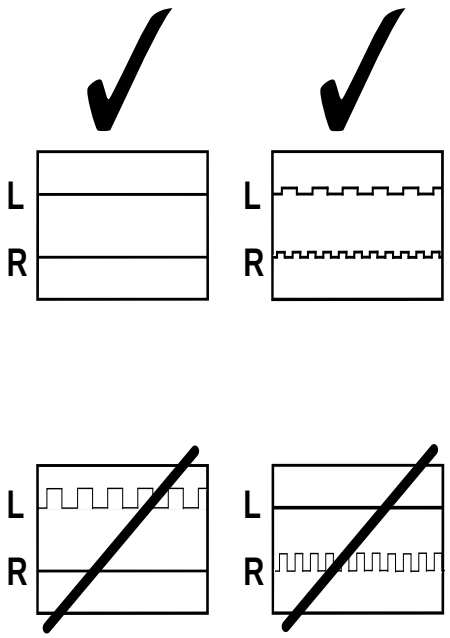
Step No.	Action	Indication
4		
5		
6		

b. Optical Preamplifier Adjustments

Notes
On the Cat. No. 510 Card: Turn all of the **Proj 1** and **Proj 2** high freq potentiometers fully counterclockwise (CCW). Verify that power to the power amplifiers are OFF.
Press the **format 04,** Dolby Stereo A-Type switch on the front panel; the LED in the switch should light.
Connect the RTA and the oscilloscope to the Cat. No. 510 **L** (left) and **R** (right) test points as shown in the interconnection diagram. Switch the scope to dual trace mode. Be sure that the vertical range is set the same on both channels. Earth (ground) both instruments at **GND** on the card. The input to the RTA will be switched to the left channel or right channel in the following steps.

A-Chain Alignment Procedures

b. Optical Preamplifier Adjustments

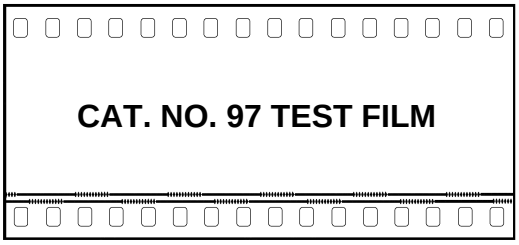
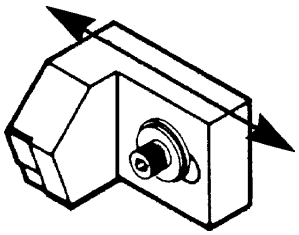
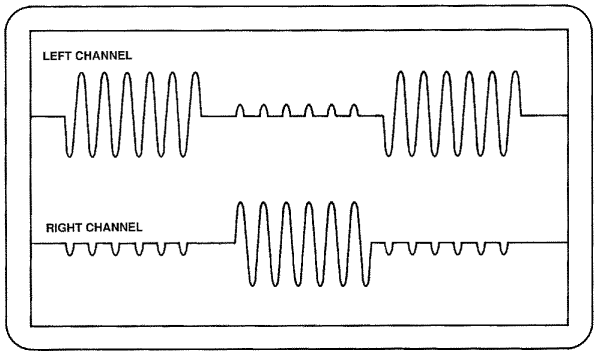
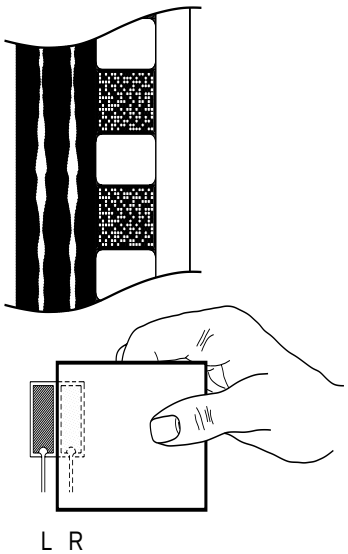
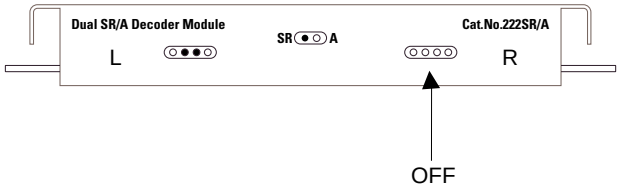
Step No.	Action	Indication
7		
8	 	 OSCILLOSCOPE TRACES

b. Optical Preamplifier Adjustments

Notes
Thread and play the Cat. No. 69T Dolby Tone test film for an initial test of the signal path through the projector preamplifier. The film emulsion should face away from the screen. Adjust the Cat. No. 510 **Proj 1 L** and **R** gain potentiometers until the LEDs on the Cat. No. 222SR/A Decoder Module indicate that Dolby level — the center two green LEDs are lit. In addition, verify that the signal present LED for the center channel, located on the front panel, is lit. The Dolby tone signal also should be visible on the oscilloscope.
Remove the Cat. No. 69 test film and thread the SMPTE Buzz Track Film. This film has modulation just beyond the normally scanned areas of the optical sound tracks. The objective of this test is to ensure that the slit illuminates only the sound-tracks. Depending on the design of the projector, the positioning of the slit relative to the optical tracks is adjusted as follows: The film guide is adjusted laterally for a null if the lens and exciter lamp are fixed in position; The lens and exciter lamp assembly are adjusted laterally for a null if the film cannot be moved laterally. The adjustment is correct when there is no signal output while the film is played. It may not be possible to adjust for a null with some older slits; in such instances, adjust for a minimum and equal signal on L and R. Some projectors use a lens with an adjustable slit width. The adjustment is correct at the point when the left and right signals both disappear equally.

A-Chain Alignment Procedures

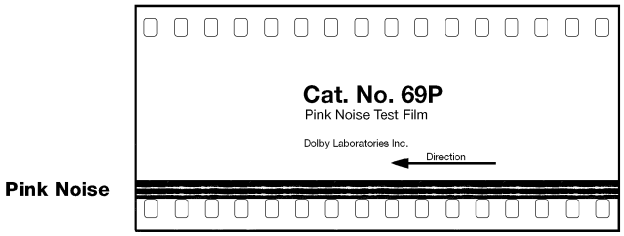
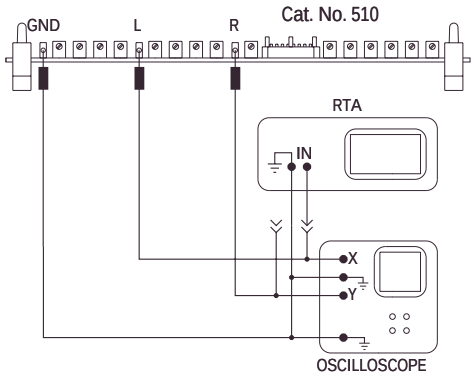
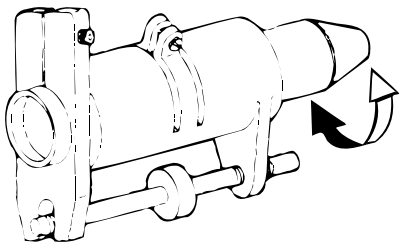
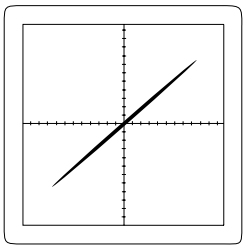
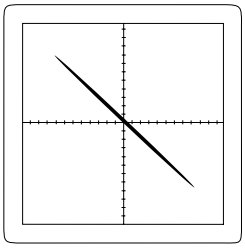
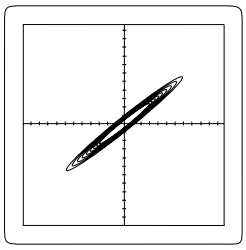
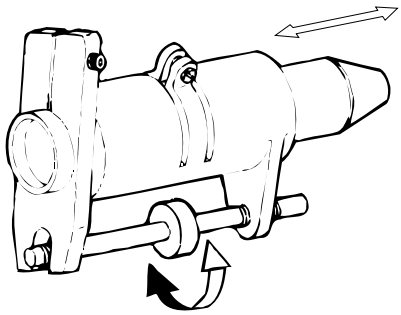
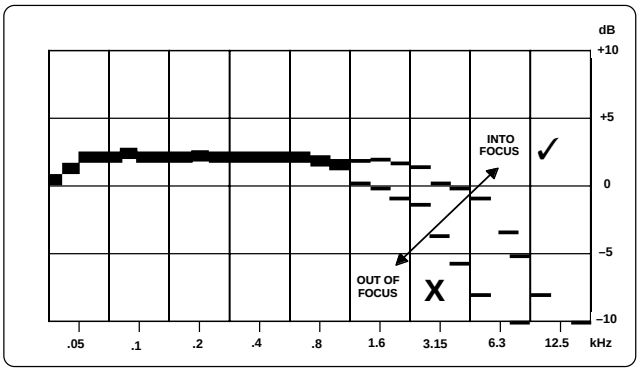
b. Optical Preamplifier Adjustments

Step No.	Action	Indication
9	Left-Right  	 **OSCILLOSCOPE TRACE**
10		
11	**REPEAT 8 AND 9**	

b. Optical Preamplifier Adjustments

Notes
Remove the SMPTE Buzz Track Film and thread and play the Cat. No. 97 Stereo Cell Alignment Film. While the film is playing, look at the oscilloscope. If a large amount of crosstalk is present, loosen the stereo solar cell head and move the head from side to side until the crosstalk is minimum and equal. (The right channel is the track toward the outside of the projector.) **NOTE:** On some projectors, it may be necessary to stop the film to adjust the position of the cell. The right channel is the track toward the outside of the projector. Lock the cell bracket into position after completing this adjustment. Check that the crosstalk has not changed as the bracket was tightened.
Verify that the outputs of the right and left solar cells are properly connected by placing a white card over the right solar cell (nearer the outside of the projector) and confirming that the level of the right channel drops — as indicated by the right channel LEDs located on the Cat. No. 222 SR/A module.
Repeat the SMPTE Buzz Track alignment in Step 8. If the film or optics/exciter lamp position must be readjusted, repeat Step 9. The optimum setting is attained when no further adjustments are required in Steps 8 and 9.

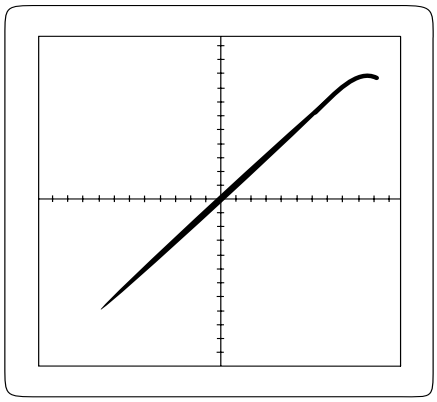
b. Optical Preamplifier Adjustments

Step No.	Action	Indication
12	  **SET TO X/Y MODE** 	**OSCILLOSCOPE TRACES** ✓  X  **Out of phase** X  **Incorrect azimuth**
13		 **RTA DISPLAY**

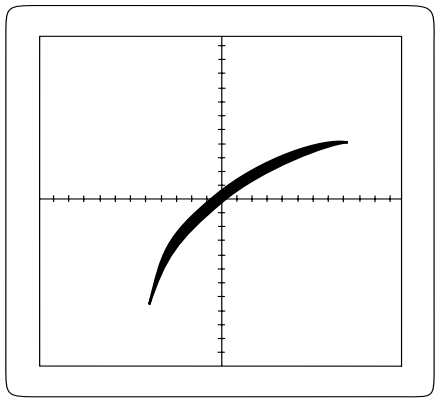
Notes

Thread and play the pink noise on the Cat. No. 69 film (emulsion away from screen). Connect the RTA to the left test point **L** on the Cat. No. 510.

Switch the oscilloscope to the X/Y mode and adjust the azimuth of the projector optics for the narrowest diagonal trace. (Blooming at the ends of the trace may be caused by improper lighting of the edges of the optical tracks. If necessary, repeat the cell alignment steps or the exciter lamp position step to reduce such blooming to a minimum.)

X 

Not enough light on one channel

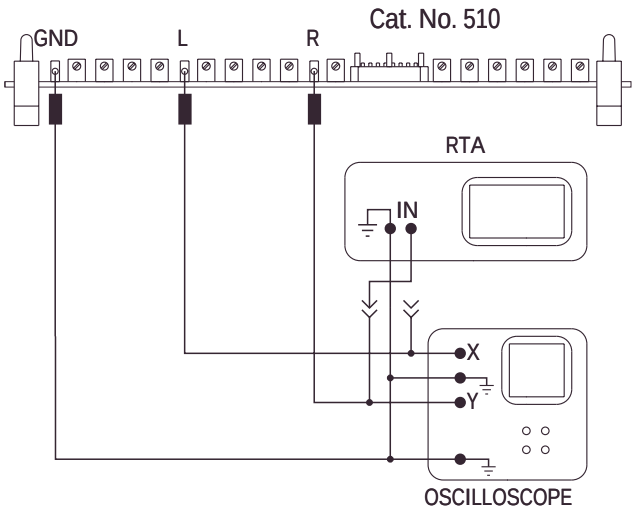
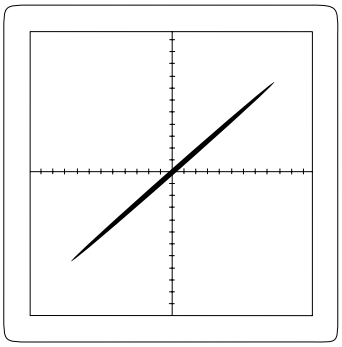
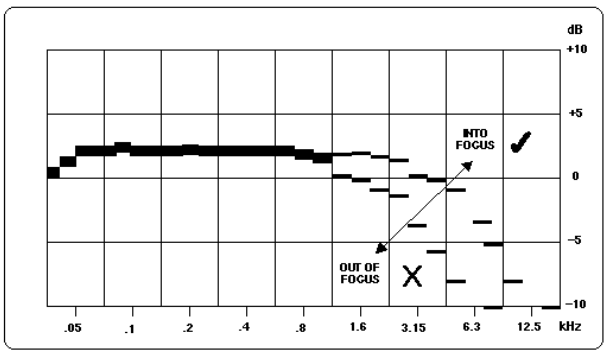
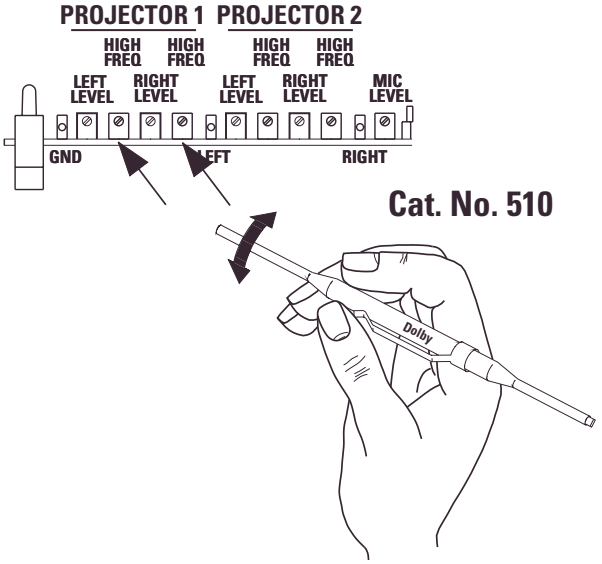
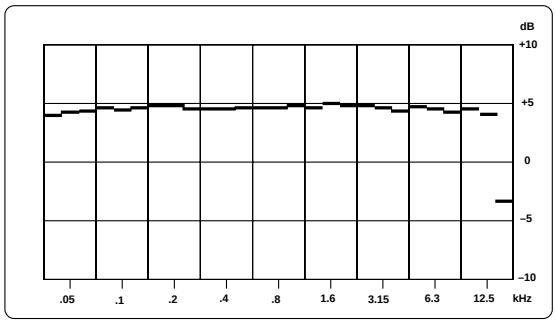
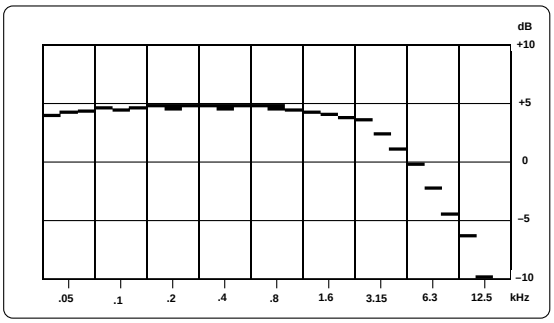
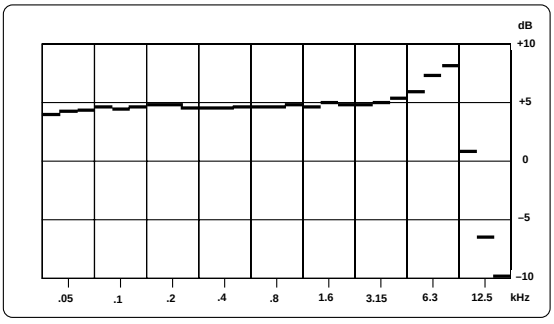
X 

Uneven light on cell

While observing the trace on the RTA, adjust the focus of the sound track lens for the best high frequency response. The trace shown in the example is ideal; merely attempt to obtain the best response. The azimuth and focus adjustments interact so you must repeat Steps 12 and 13 until no further adjustments are required.

A-Chain Alignment Procedures

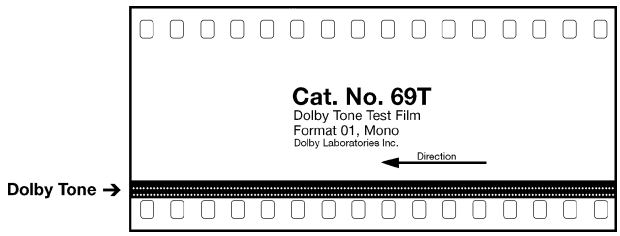
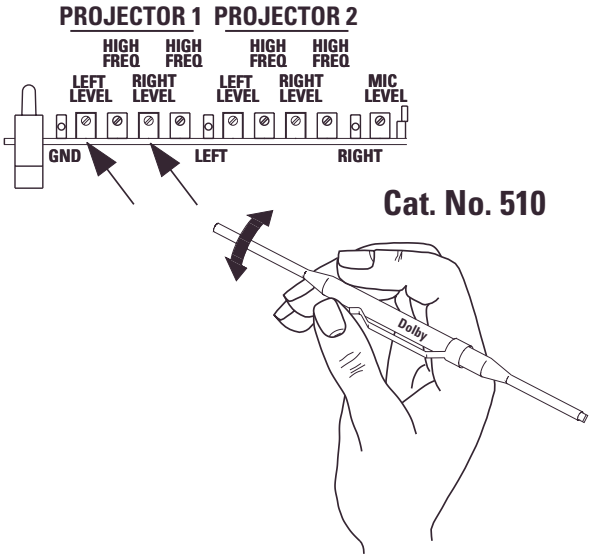
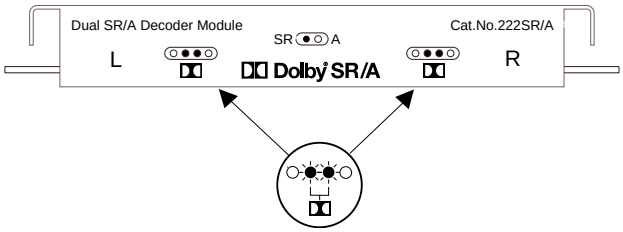
b. Optical Preamplifier Adjustments

Step No.	Action	Indication
14	 **REPEAT 12 AND 13**	 
15		✓  X  X 

Notes
Disconnect the RTA from the left test point and connect it to the right test point **R.** Then repeat Steps 12 and 13. **NOTE:** The azimuth and high frequency response must be the same at both the left and right test points. If results are not similar, it may be necessary to remove the lens and check for oil or contamination or a degraded slit. Replace the lens, if necessary. **Do not proceed to the next step until the outputs at both the left and right test points are similar.**
The test in this step is performed both at the right and left channel test points of the Cat. No. 510 card. The frequency response must be within 1 dB to at least 12 kHz. Adjust the **L high freq** and **R high freq** potentiometers on the Cat. No. 510 card for the most extended high frequency response without "peaking." If these adjustments do not improve the frequency response, the problem may be a degraded slit or damage to the lens.

A-Chain Alignment Procedures

b. Optical Preamplifier Adjustments

Step No.	Action	Indication
16	 	
17	**FOR PROJECTOR NO. 2** **REPEAT 1 → 16**	

b. Optical Preamplifier Adjustments

Notes
Thread and play the Cat. No. 69T Dolby Tone test film. Verify that the Dolby tone indication is shown on the Cat. No. 222 SR/A card (the center two green LEDs are lit for both the R and L channels). If necessary, re-adjust the **Proj 1** left and right **gain** controls on the Cat. No. 240A card. Do not re-adjust the hf controls.
Repeat all of the above steps for projector No. 2.

SECTION 5
B-CHAIN ALIGNMENT

5.1 Check Theater Equipment

Thoroughly check the loudspeakers and power amplifiers for sources of poor performance:

- Check that the loudspeaker cables are in good condition and that they of a suitable gauge for the impedance of the speakers and the length of the run.
- Rattles (a leak in the woofer cabinet may appear to be a rattle).
- Loose bolts or other hardware.
- Open drivers.
  In systems with pairs of drivers — woofers or tweeters — one voice coil of the pair may be open but the system will still function. Check the speakers with an ohmmeter. If one channel requires markedly more equalization than the other or if one speaker overloads at lower levels than the other speakers, an open driver circuit could be the cause.
- Missing drivers or other components.
- The settings of the crossovers to match the type of drivers in use and the acoustics of the theater.
  The tweeter level control must be set for the best possible frequency response before you attempt any equalization. This is also true if the system uses active crossovers with bi-amp equipment.
- Phasing between the woofers and tweeters, and between the channels.
- Aiming of speakers.
  Check that the speakers are correctly aimed into the auditorium, and that they are not obstructed by the screen frame, struts or other obstructions.
- Check that speakers are correctly connected; that the speaker on the left is connected to the left power amplifier, etc.

Amplifiers

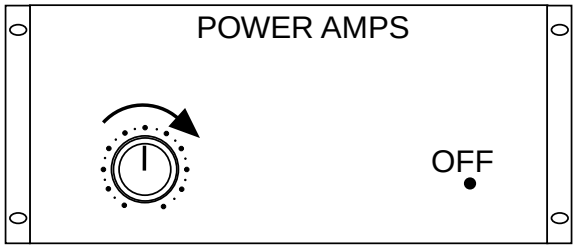
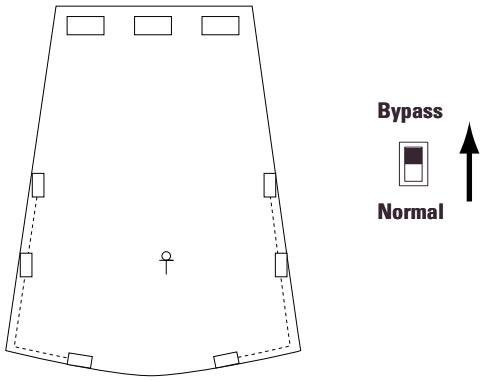
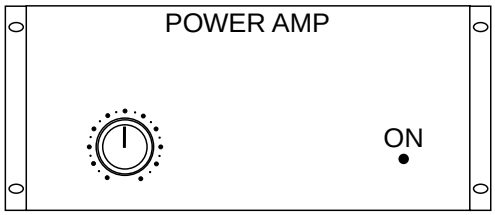
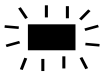
- Distortion.
- Gross gain differences among amplifiers.
  If one amplifier differs in performance from the others, it should be checked and repaired before proceeding further. Input gain controls should all be at the same setting.
- Blown fuses.
  Some types of power amplifiers operate at very low gain and distortion even if fuses are blown.
- Good air movement through power amplifiers.

Air-conditioning

If air-conditioning noise is audible in the theater, arrange for lubrication of the motor, fan bearings, adjustment of belts and drives and cleaning of filters to reduce the ambient noise to a minimum.

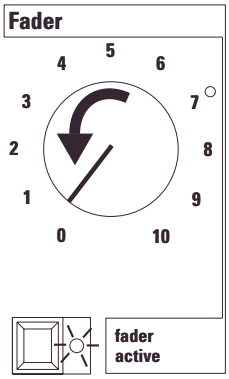
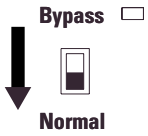
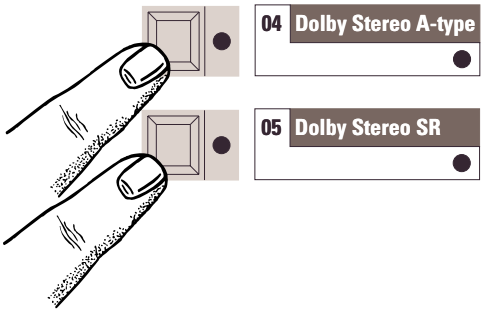
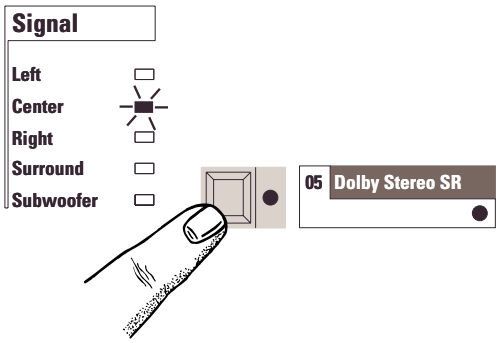
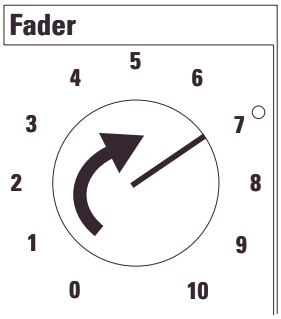
B-Chain Alignment Procedures

5.2 Setting Room Equalization

Step No.	Action	Indication
1	  	Bypass 

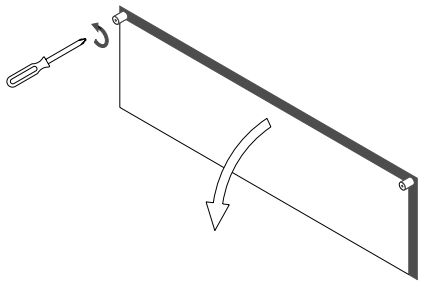
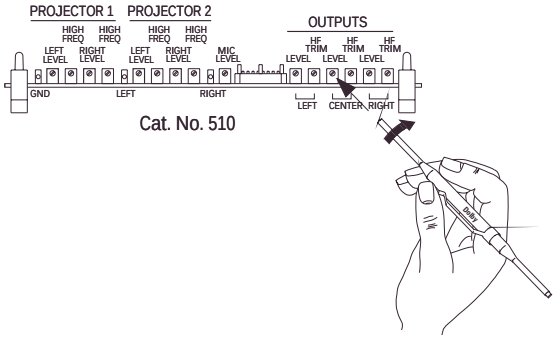
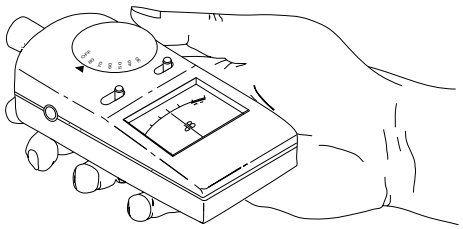
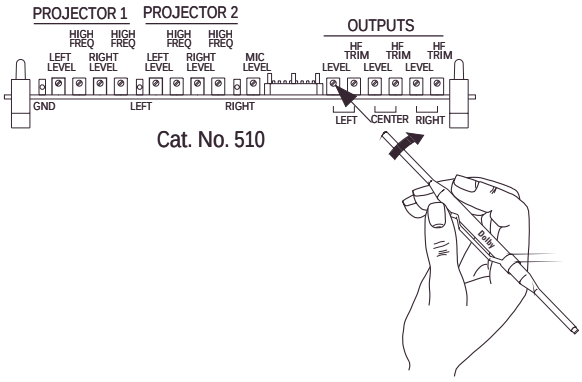
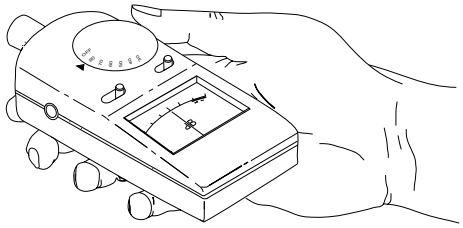
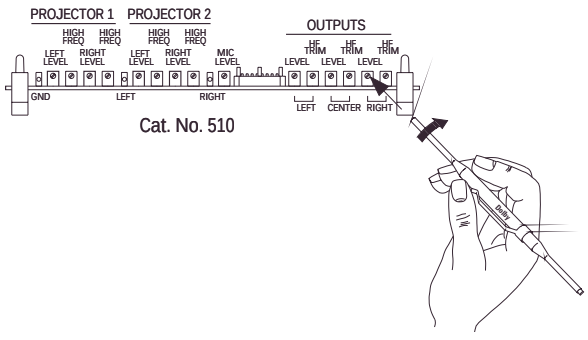
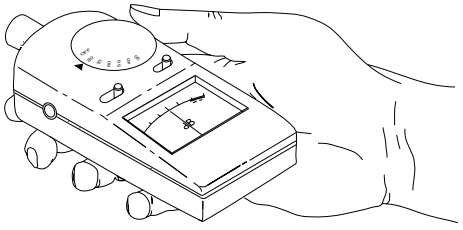
Notes
5.2 Room Equalization Equalization is performed using the real-time analyzer and a calibrated microphone(s). The adjustment for the full range channels involves setting 7-band equalizer controls for each of the screen channels (left, center, and right), and a 3 band equalizer for the surround channel(s). The ideal setting is reached when the room response readings on the RTA match the standard curves shown in this manual. The Left, Center, and Right channel response should extend smoothly from 40 or 50 Hz to significantly beyond 10kHz, and ideally as far as 16kHz. The level difference between any two locations in the normal seating area of the theater, measured in 1/3 octaves from 150Hz to 10kHz, should not exceed 3 dB.
Set all the gain controls on all power amplifiers to a known repeatable setting, but do not turn amplifiers on. The preferred setting for the amplifier gain controls is maximum. If a different setting is required in order to optimize the noise performance of the system, the controls should be locked in position or marked clearly. Position calibrated microphones in the theatre. Whenever possible use multiple microphones and a multiplexer. For a single microphone the recommended position is shown in the diagram — 2/3 of the way from the front speakers to the rear — but off the axis of the center speaker — 5 feet off the floor level — and angled 45 degrees upward toward the screen. Connect the microphone to the RTA. Set the front panel **NORMAL/BYPASS** switch on the CP45 **BYPASS**. Turn power **ON** to the power amplifiers.

5.2 Setting Room Equalization

Step No.	Action	Indication
2		
3		
4		
5		
6		

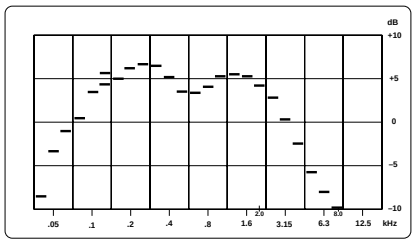
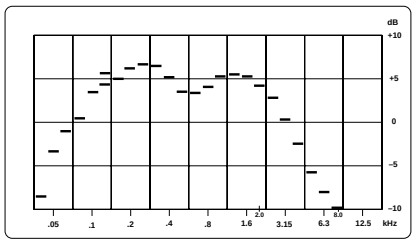
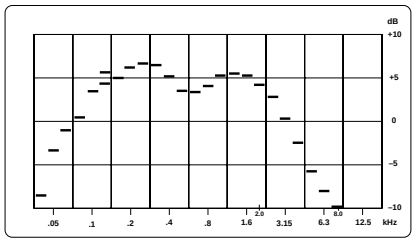
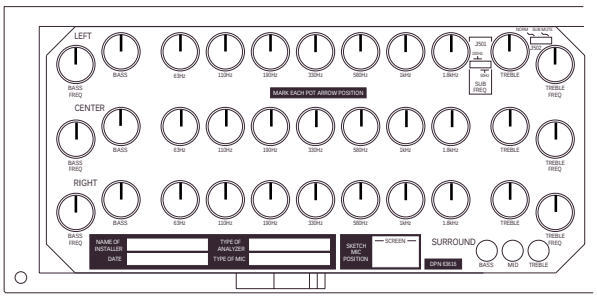
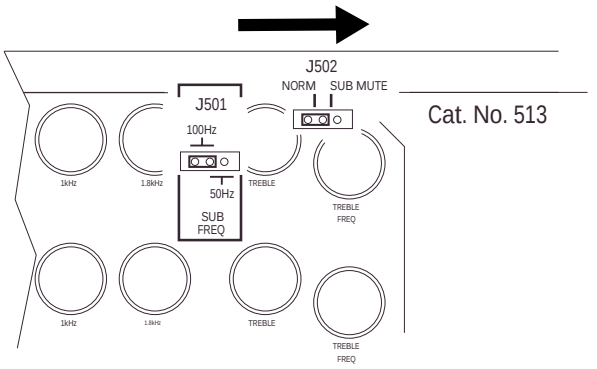
Notes
Set the **FADER** to the 0 position. Verify that the fader local active LED is on. If necessary, press the **FADER ACTIVE** switch.
Set the **NORMAL/BYPASS** switch to the **NORMAL** position.
Simultaneously press and hold the 04 and 05 switches until the mic LED lights (approximately 7 seconds). When the 04 and 05 switches are released, the mic's LED will flash and internally generated pink noise will automatically cycle L,C,R,S,L…etc.
Press the 05 switch when the signal present LED on the front panel for center is illuminated. This will suspend the cycling. Note: Pressing the 04 switch will cause the cycling to resume. Pressing the mic button will turn off the pink noise.
Slowly advance the **FADER** control to position **7**. You should hear pink noise.

5.2 Setting Room Equalization

Step No.	Action	Indication
6		
7	 PROJECTOR 1 PROJECTOR 2 OUTPUTS HIGH FREQ HIGH FREQ HF TRIM LEFT LEVEL RIGHT LEVEL MIC LEVEL GND LEFT RIGHT LEFT CENTER RIGHT Cat. No. 510	75-80 dBC 
8	REPEAT 11 → 12  PROJECTOR 1 PROJECTOR 2 OUTPUTS HIGH FREQ HIGH FREQ HF TRIM LEFT LEVEL RIGHT LEVEL MIC LEVEL GND LEFT RIGHT LEFT CENTER RIGHT Cat. No. 510	75-80 dBC 
9	 PROJECTOR 1 PROJECTOR 2 OUTPUTS HIGH FREQ HIGH FREQ HF TRIM LEFT LEVEL RIGHT LEVEL MIC LEVEL GND LEFT RIGHT LEFT CENTER RIGHT Cat. No. 510	75-80 dBC 

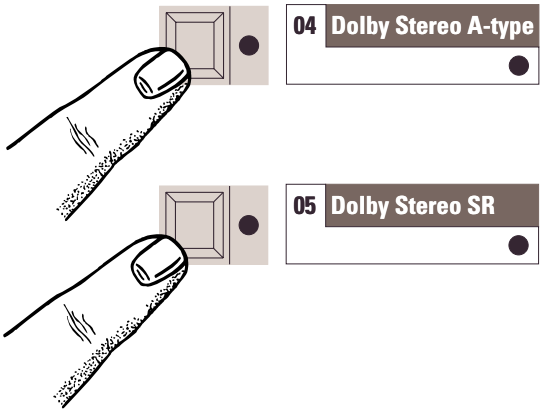
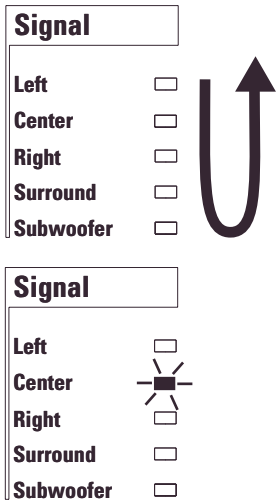
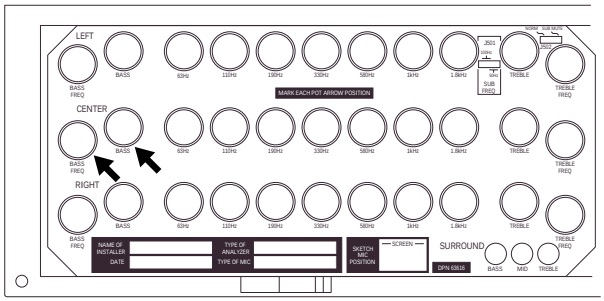
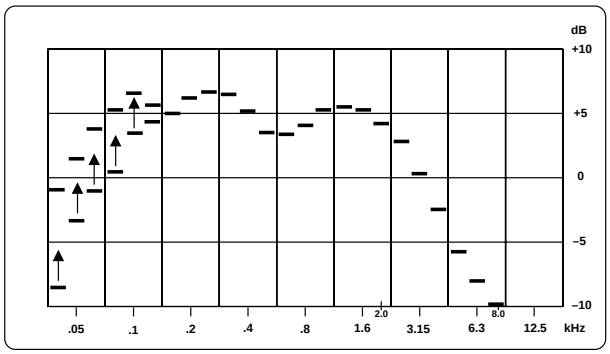
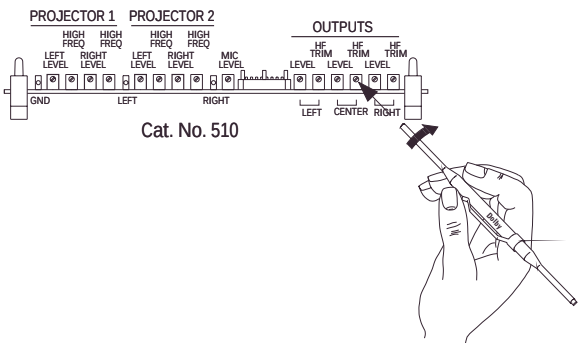
Notes
Open the CP45 front panel.
With a sound pressure level meter located at the position in the theatre used for step 6, adjust the center channel level control on the Cat. No. 510 card until the channel produces a reading of 75-80 dBC. (After room equalization for all channels is adjusted, the sound pressure level will be set to 85 dBC.) The pink noise should be at least 20 dB above the background noise level of the theatre. If a level of 75-80 dBC cannot be obtained, adjust the gain of the power amplifiers and try again.
Repeat steps 11 and 12 for the left and right channels.

5.2 Setting Room Equalization

Step No.	Action	Indication
10	Left  Center  Right 	
11	 LEFT CENTER RIGHT BASS FREQ BASS TREBLE TREBLE FREQ MARK EACH POT ARROW POSITION NAME OF INSTALLER DATE TYPE OF ANALYZER TYPE OF MIC SKETCH MIC POSITION SCREEN SURROUND BASS MID TREBLE	
12		

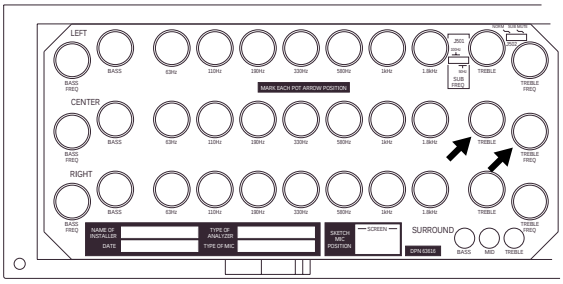
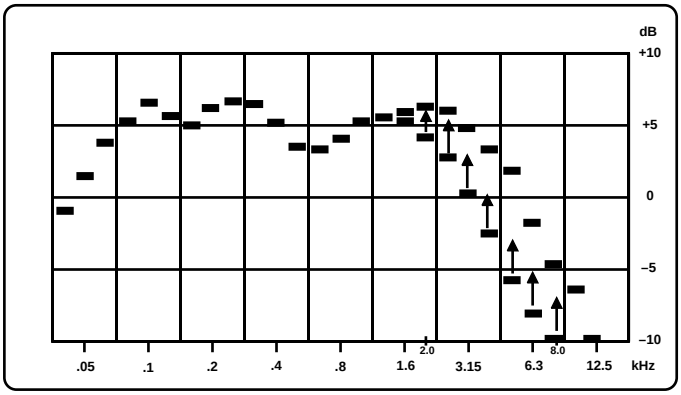
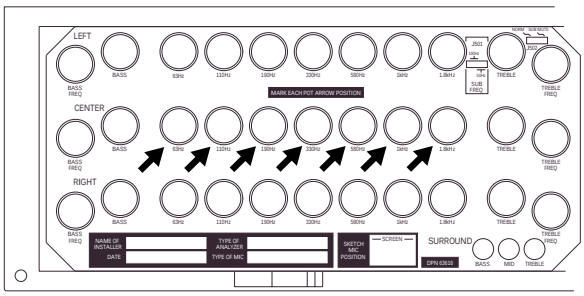
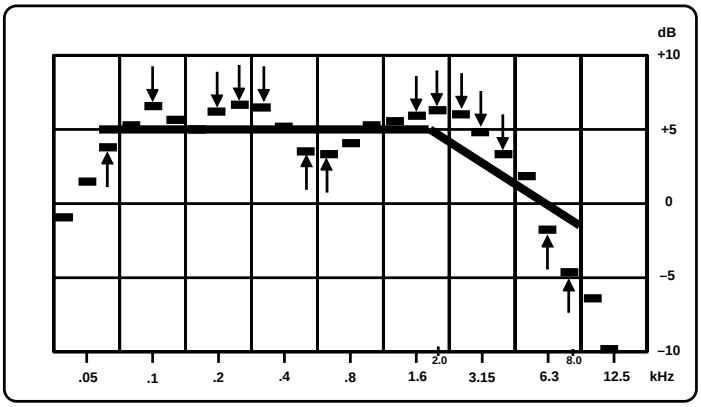
Notes
Compare the response displayed on the real time analyzer (RTA) for each channel (L, C, R). All should show a similar shape. Any large differences indicate faulty or misaligned crossovers or defective speakers. Speaker phasing could also be at fault. See Appendix A.
Set the EQ controls on the EQ board (inside the front panel) to 12 o'clock.
Move the **NORM/SUB MUTE** jumper on the EQ board to **SUB MUTE**.

5.2 Setting Room Equalization

Step No.	Action	Indication
13		
14		
		

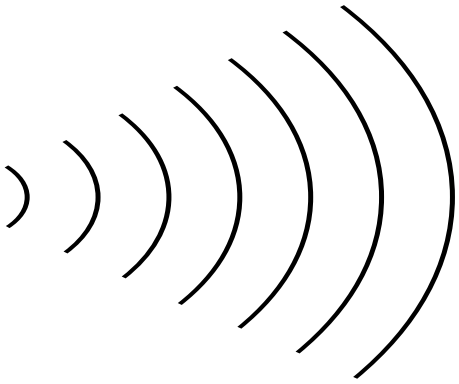
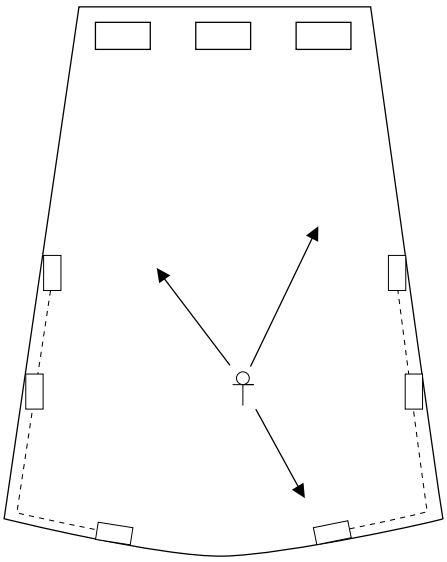
Notes
Cycle the pink noise to the center channel.
While observing the RTA, adjust the bass controls on the EQ board so that the bass frequency response is as flat as possible. The left hand L.F. control sets the frequency range. The right hand L.F. control sets the boost or cut.
Next, adjust the H.F. trim control on the Cat. No. 510 card so that the level of the H.F. section of the curve matches the level of the midfrequency section.

5.2 Setting Room Equalization

Step No.	Action	Indication
16		
17		

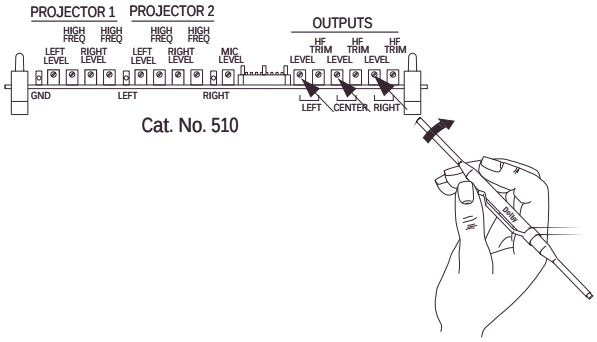
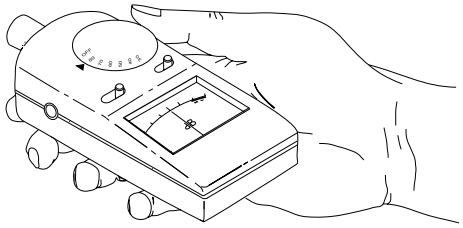
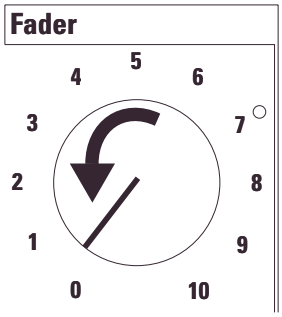
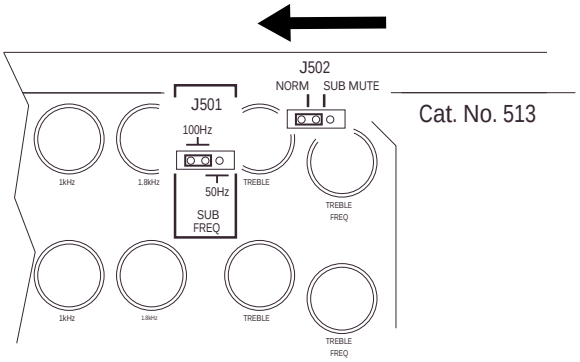
Notes
Adjust the treble controls on the EQ board for as flat a response as possible up to 2 kHz, followed by a 3 dB per octave roll-off above 2 kHz. The right hand H.F. control sets the frequency range. The left hand H.F. control sets the boost or cut.
The next step is to fine-tune the equalization by adjusting the EQ controls on the EQ board. There are certain rules to keep in mind: • All of the equalizer controls interact with each other so you should not start at the low end of the response curve and merely work your way to the high end. As each control is adjusted, the response obtained by adjustment of adjacent controls is affected. • Start at the center frequency and attempt to achieve results with cut rather than with boost. The desired curve is a flat frequency response up to 2 kHz, falling at 3 dB per octave to 8 kHz (1 dB per third-octave band). • If modern woofer systems (vented-box direct radiator enclosures) are installed in the theatre , moderate bass equalization down to 40 Hz may be used. • Once an adjustment seems OK, work on the frequencies to either side of it. You may find that a cut at one frequency is followed by a slight boost at adjacent frequencies. Although the equalization may be set correctly for the chosen microphone position, it still may not be correct for providing the best sound to the greatest number of seats in the theater. You should therefore check the sound quality at several locations (three or more) in the auditorium with the calibrated microphone and RTA system. If time does not permit this procedure, walk around the theater with pink noise playing. If necessary, adjust the equalizer for a compromise at several seat positions so that all of them sound acceptable. Mark the settings for each control on the white card provided.

5.2 Setting Room Equalization

Step No.	Action	Indication
18		
19		
20	**REPEAT** **L** 11 → 12 **R** 11 → 12	

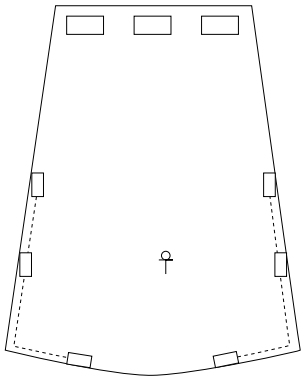
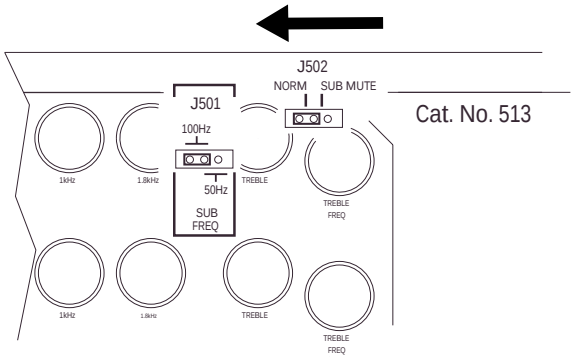
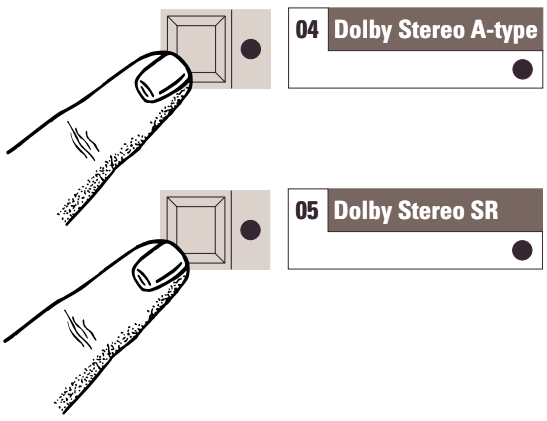
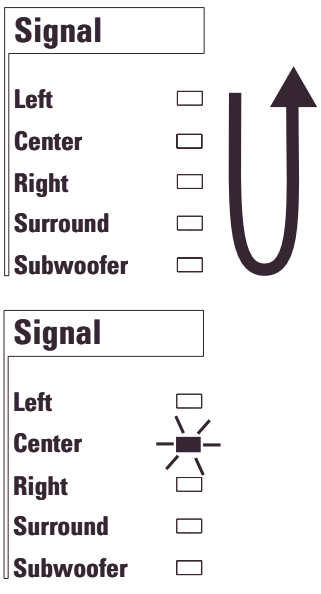
Notes
If the sound quality varies significantly as you walk around, the equalization has not been adequate: • You may have over equalized. Check the positions of the controls; all should be as close to 12 o'clock as possible. • There may be phase shift present if the adjacent controls are pointed in opposite directions, especially if you did so to eliminate a sharp dip that resulted from physical problems in the auditorium (horn location, speaker orientation). • The size of the room may be a multiple of a given wavelength, wall surfaces are parallel, or there may be a severe balcony overhang. There may be reflection off the walls behind the screen or crosstalk from adjacent theatres. • The seat and seat materials may be too reflective. • The microphone may have been placed in an untypical position.
Repeat the procedure with the microphone in other average locations in the auditorium. Adjust the controls for the best compromise to fit all of the locations of the microphone.
Repeat Steps 16 to 20 for the left and right channels.

5.3 Adjusting L,C,R Output Levels

Step No.	Action	Indication
21		85 dBC 
22		
23		

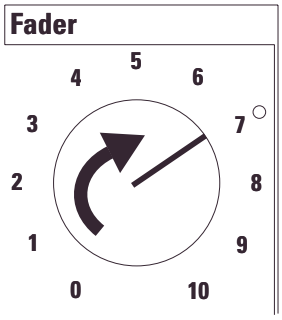
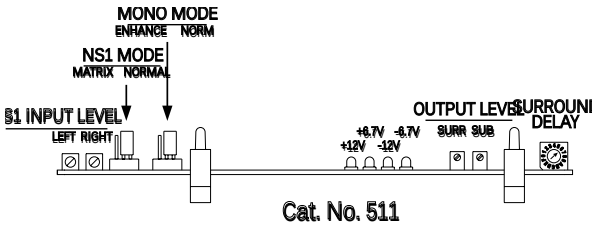
Notes
Cycle the pink noise and adjust the L, C and R level controls on the Cat. No. 510 so that each channel produces 85 dBc in the theatre, as measured by the sound level meter at the location described in step 15 above.
Set the fader to position 0.
Return the **NORM/SUB MUTE** jumper to **NORM**.

5.4 Subwoofer Alignment

Step No.	Action	Indication
24		
25		
26		

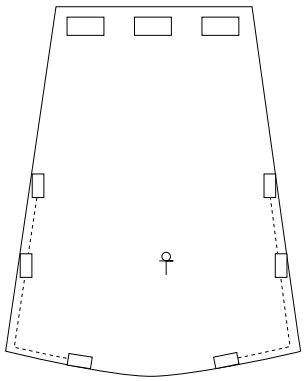
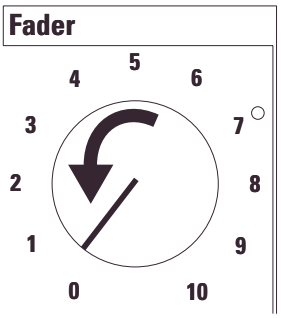
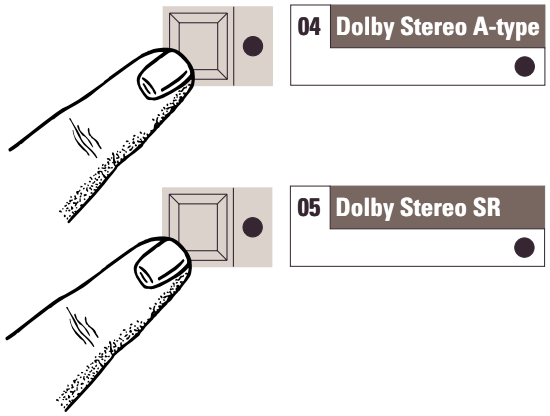
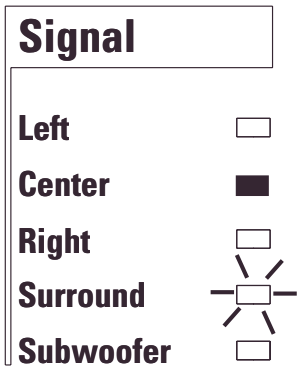
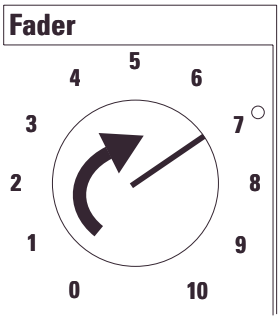
Notes
Confirm that the microphone is in the position defined on page 5-7. All connections established in the room equalization procedure apply to the following steps.
Insure that the **NORM/SUB MUTE** jumper on the EQ board is in the **NORM** position.
Cycle the pink noise to the center channel.

5.4 Subwoofer Alignment

Step No.	Action	Indication
21		
25		
26		

Notes
Slowly advance the fader to position 7. The subwoofer and center channel response should be observed on the RTA.
Adjust the subwoofer output level control on the Cat. No. 511 to match the level of the midrange frequencies.
While observing the RTA, note the change in the average level of the bands from 20 Hz to 100 Hz when the subwoofer is turned on and off via the norm/ test connector on the EQ board. There should be a level increase when the subwoofer is on norm. The subwoofer is out of phase with the center channel if you do not see this level increase. Reverse the subwoofer(s) speaker connections if necessary.

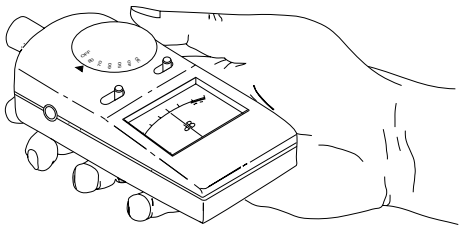
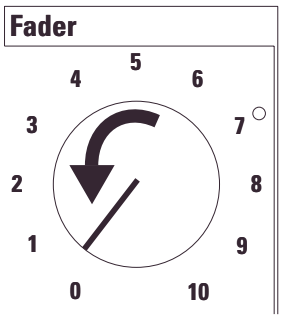
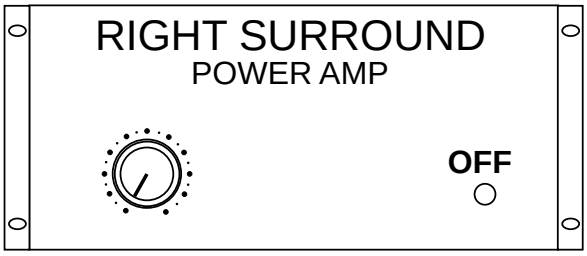
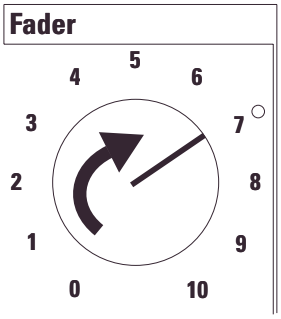
5.4 Surround Alignment

Step No.	Action	Indication
29		
30		
31		
32		

5.4 Surround Alignment

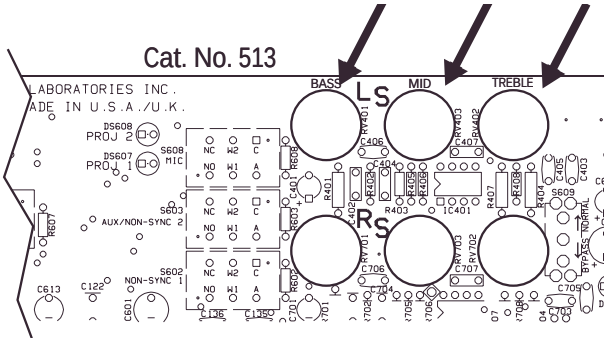
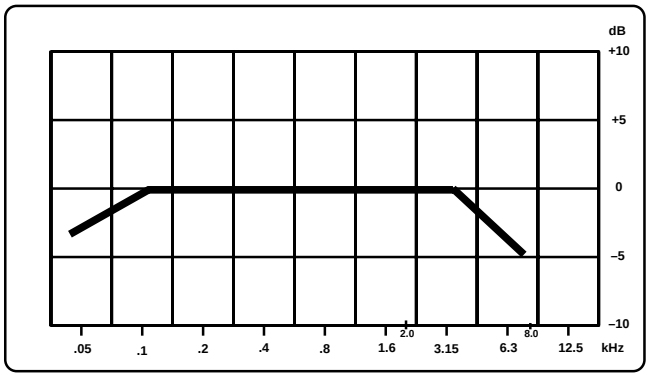
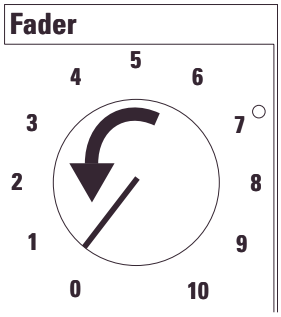
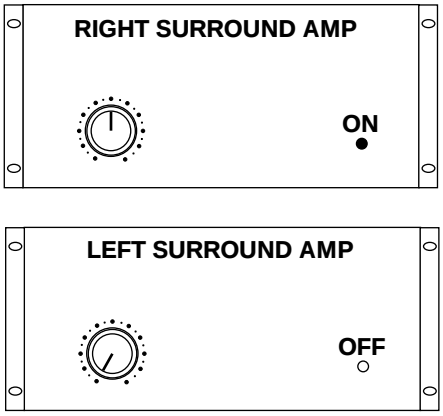
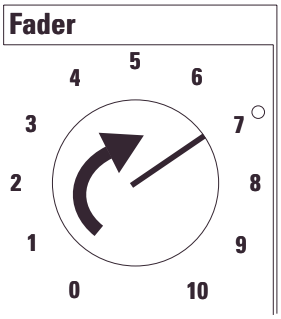
Notes
Confirm that the microphone is in the position defined on page 5-3 All connections established in the room equal. procedure apply to the following steps.
Set the fader to position 0.
Cycle the pink noise to the surround channel.
Slowly advance the fader to position 7.

5.4 Surround Alignment

Step No.	Action	Indication
33	85 dBC 	
34		
35		
36		

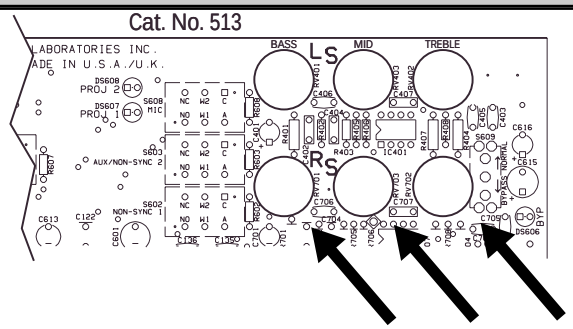
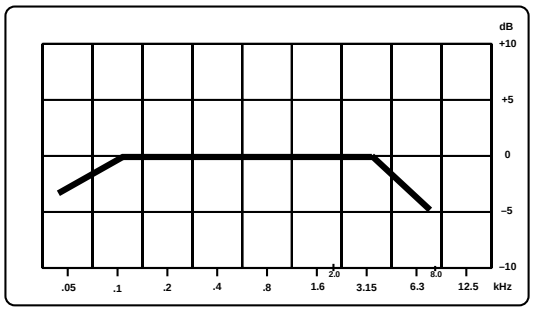
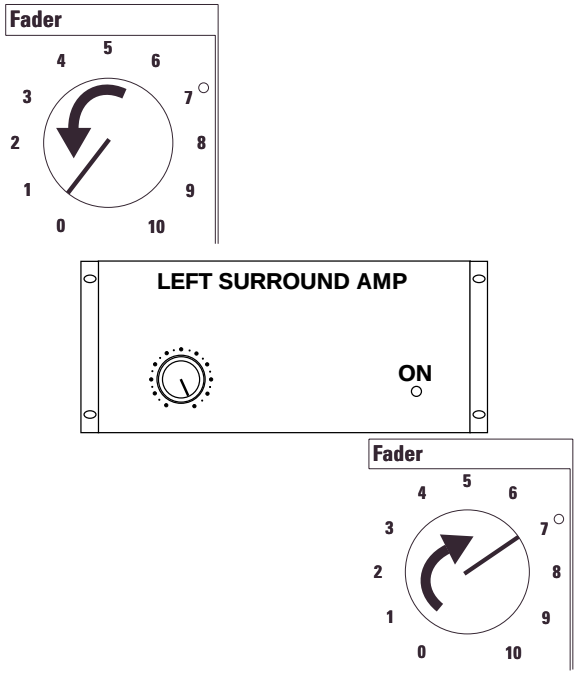
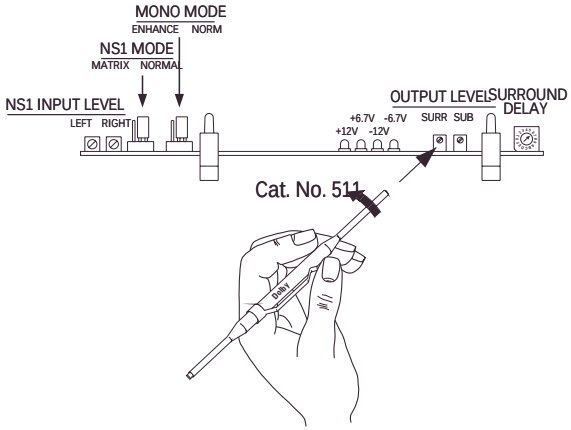
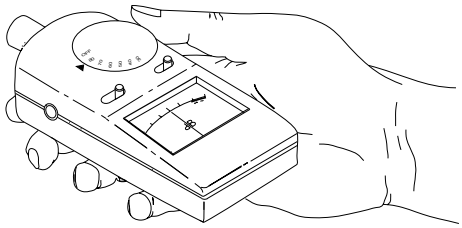
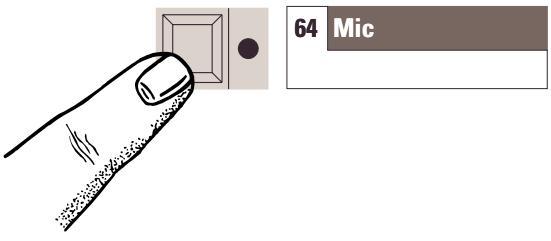
Notes
Adjust the surr output control for a sound pressure level of approximately 85 dBC in the theatre.
Set the fader to position 0.
Turn off the Rs power amplifier.
Set the fader to position 7.

5.4 Surround Alignment

Step No.	Action	Indication
37		
38		
39		
40		

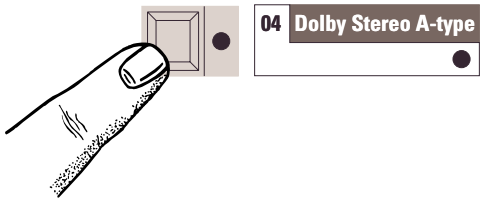
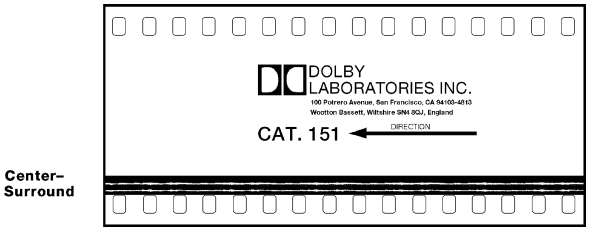
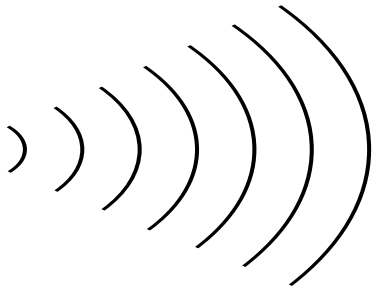
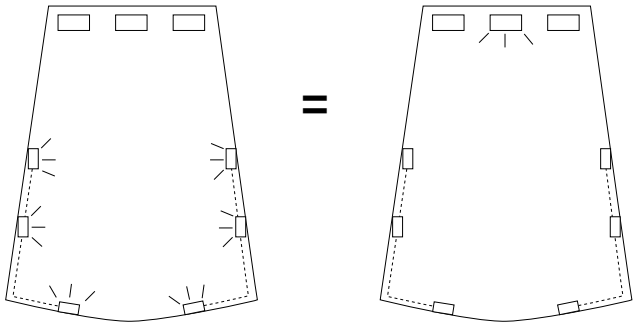
Notes
Adjust the **Left Surround EQ controls** on the EQ board to match the figure as closely as possible. Use caution when adjusting the bass control; many surround loudspeaker systems are deficient in their low frequency response. Attempts to boost the output of such systems beyond their capabilities simply wastes amplifier power and can result in distortion and possibly damage to the surround loudspeakers. The equalizer controls interact. Repeat the adjustments until no further adjustment is required and you have attained the optimum frequency response.
Set the fader to position 0.
Turn on the Rs power amplifier. Turn off the Ls power amplifier.
Set the fader to position 7.

5.4 Surround Alignment

Step No.	Action	Indication
41		
42		
43		85 dBC 
44		

Notes
Adjust the right surr EQ controls on the EQ board to match the figure curve as closely as possible.
Set the fader to position 0. Turn on the Ls power amplifier. Set the fader to position 7.
With the microphone still located near the center of the theatre, adjust the **surr output** control on the Cat. No. 511 card for a sound pressure level of 85 dBC.
Press the mic button, format 64, to restore the CP45 to normal operation.

5.4 Surround Alignment

Step No.	Action	Indication
45		
46		 

Notes
Press format 04 Dolby Stereo A-type.
Thread and play the Cat. No. 151 Stereo Optical Surround Level test film. Check the sound by walking around the theatre. The surround and center channels should sound equally loud at most locations and left and right surround channels should sound equally loud and have similar frequency response in the center of the theatre. If necessary, readjust the surround output level until you are satisfied with the surround-to-front center balance. A large change in the gain setting should be unnecessary.

5.5 Setting Optical Surround Delay

The CP45 incorporates a delay line in the surround channel to ensure that sound from the rear of the theater arrives at the listeners' ears approximately 20 milliseconds after the arrival of sound from the front speakers. The delay is set into the Cat. No. 511 card via a rotary switch. Use the following formula to calculate the correct delay setting:

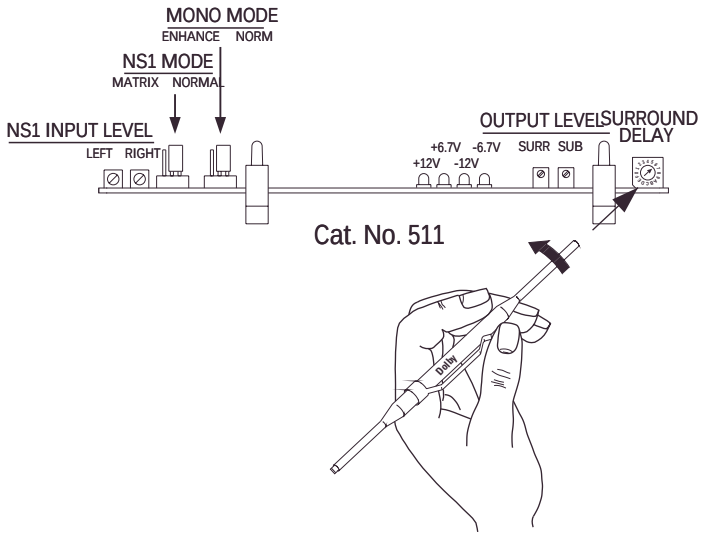
1. Estimate the distance between a rear seat and the nearest surround loudspeaker, in feet. If the metric system is used, convert the distance from meters to feet by multiplying by three (3).

2. Estimate the distance from this seat to the front loudspeakers, in feet. If the metric system is used, multiply the distance by three (3) to convert distance from meters to feet.

3. Subtract the distance measured in step 1 above from the distance measured in step 2, then add 20. The result is the delay time, in milliseconds.

Determine the Cat. No. 511 switch setting from the table below:

Delay Time (msec)	Rotary Switch Setting
0	0
10	1
20	2
30	3
40	4
50	5
60	6
70	7
80	8
90	9
100	A
110	B
120	C
130	D
140	E
150	F



For example:

The selected seat is 10 feet (3.3 meters) from the surround speakers.

The selected seat is 80 feet (26.7 meters) from the front speakers.

The delay is set for (80-10) + 20 = 90 milliseconds (switch position 9).

5.5 Setting Optical Surround Delay

You can verify that the delay setting is acceptable by listening to a familiar Dolby encoded film which ideally contains both center channel dialogue and some discernible surround sound. The Dolby Cat. No. 251 SR/Digital "*Jiffy*" film serves excellently for this purpose. If a stereo film is not available, the delay time can be checked with a mono film, if the film is played in format 04 Dolby A-type. Make certain all speakers are ON for this test.

While the film is playing, walk around the theater and carefully listen to the surround speakers when there is center channel dialogue. The dialogue should appear to be coming from the screen with no significant dialogue coming from the surround speakers.

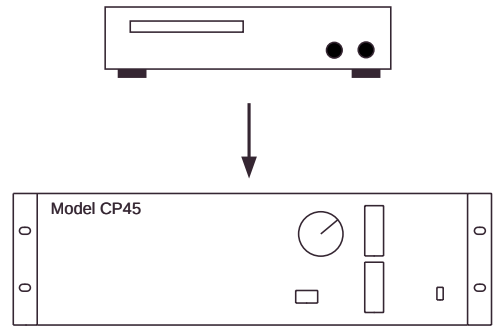
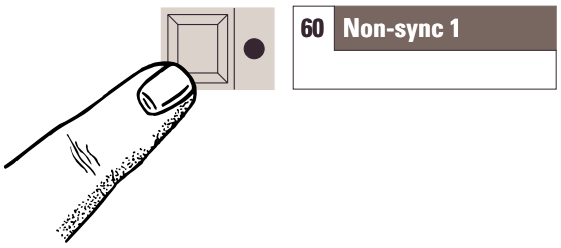
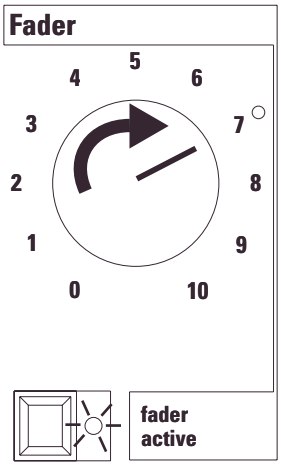
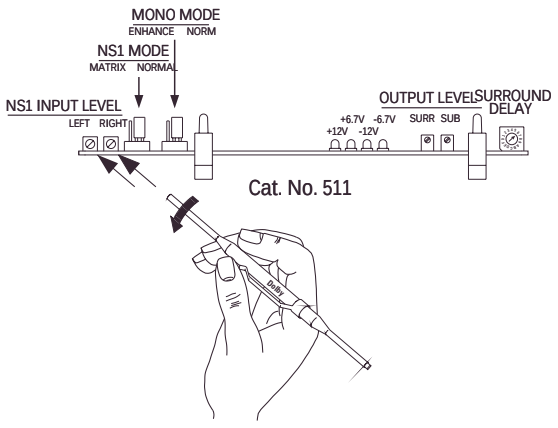
If you hear discernible dialogue from the surround speakers, the delay time was probably set too long.

If you hear an objectionable amount of dialogue from the surround speakers, which persists regardless of the delay time setting, there is probably severe gain or azimuth error in the system. Re-check both the Dolby level and the A-chain alignment of the optical system.

In many films, the surround information is intended for subtle effects and may provide only a low-level ambiance. If the surround level and delay time have been adjusted as previously described, the surround information will be at the level desired by the film director. Do not be tempted to increase the surround level because the effect desired by the film production team may be impaired or destroyed.

Connect a cassette deck or CD player to the **from non sync** terminals on terminal block TB6 on the backplane of the CP45.

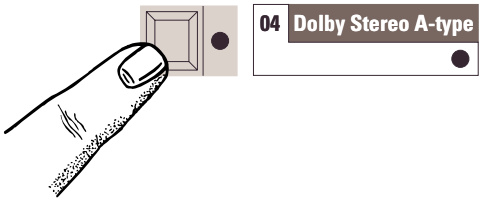
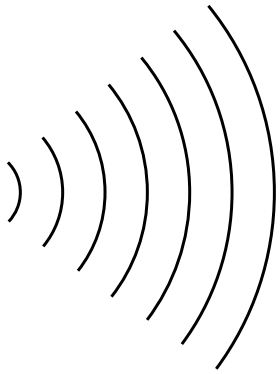
5.6 Non-sync Level Adjustment

Step No.	Action	Indication
47		
48		
49		
50		

5.6 Non-sync Level Adjustment

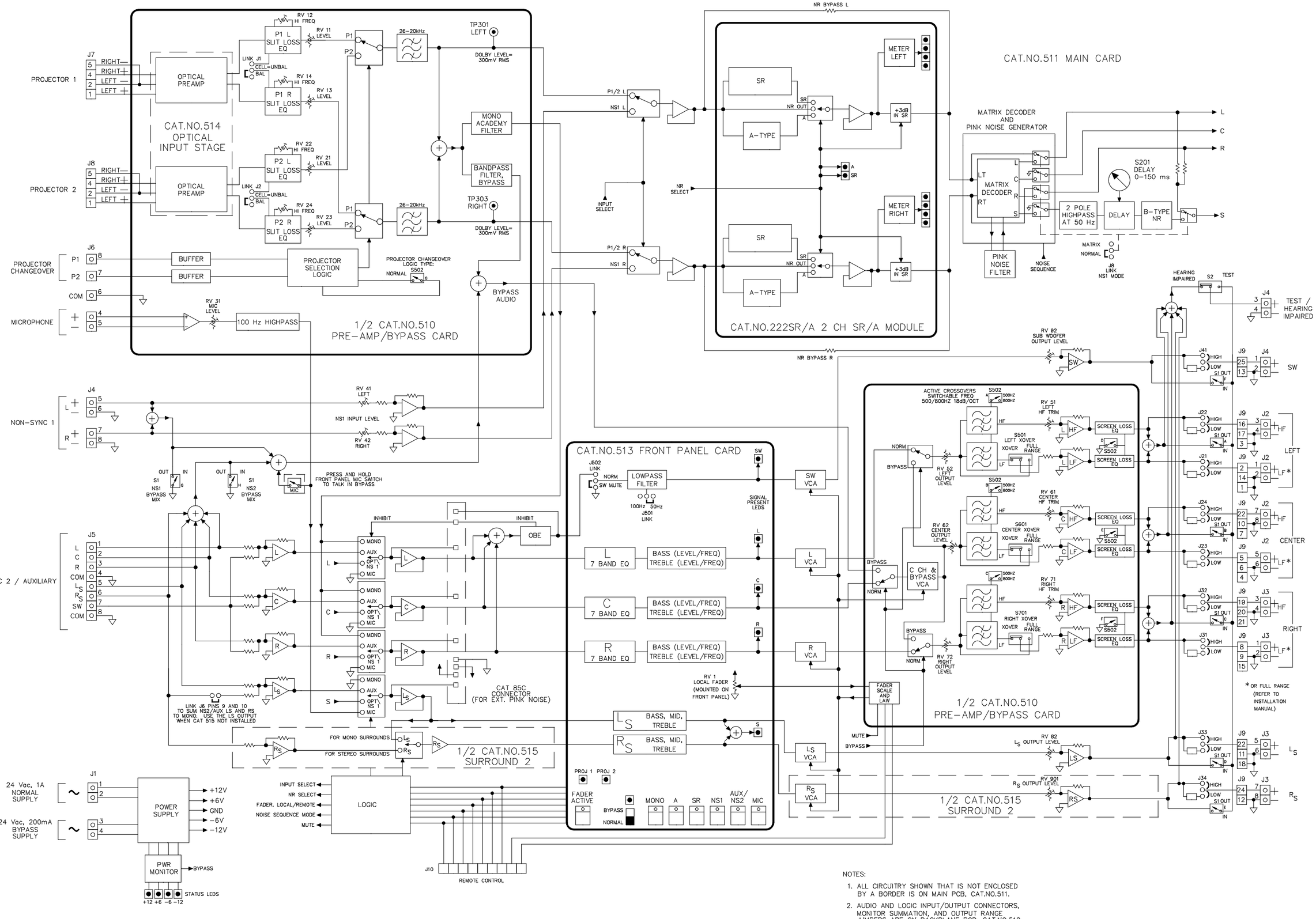
Notes
Play a music cassette or CD on the non-sync device. If possible, select a recording that has a natural ambience such as an orchestral work.
Press the **format 60 non sync** switch.
Check that the local **FADER** is selected—the local active LED on the CP45 is lit. If necessary, select the local **FADER** by pressing the **fader select** switch. Set the **FADER** to the 7 setting.
Play a cassette or CD on the non-sync device and adjust the **non-sync L** (left) and **non-sync R** (right) controls on the Cat. No. 511 card for the desired level in the theater.

5.7 Final Check

Step No.	Action	Indication
45		
46		

Notes
Press the **format 04 Dolby Stereo A-type** switch.
Thread and play the Dolby Cat. No. 351 **"listen . . ."** film on the newly aligned system. The film consists of a wide variety of short scenes—both live action and animated. Each scene was selected to demonstrate different aspects of stereo sound. Evaluate the quality of the sound. If problems occur, contact the technical staff at Dolby Laboratories.

SECTION 6
REFERENCE DIAGRAMS



NOTES:

1. ALL CIRCUITRY SHOWN THAT IS NOT ENCLOSED BY A BORDER IS ON MAIN PCB, CAT.NO.511.
2. AUDIO AND LOGIC INPUT/OUTPUT CONNECTORS, MONITOR SUMMATION, AND OUTPUT RANGE JUMPERS ARE ON BACKPLANE PCB, CAT.NO.512.
3. ⊙ INDICATES TEST POINT.
4. ■ INDICATES LED.

FA437W0A REV A
BDD 20NOV95

CP45 SIGNAL PATH BLOCK DIAGRAM

NOTES:
(UNLESS OTHERWISE SPECIFIED)

1. RESISTOR VALUES ARE IN OHMS.
2. CAPACITOR VALUES ARE IN FARADS.
3. DIODES ARE 1N4148.
4. FILTERS ARE 100MHZ 2K2 WITH BEADS.
5. ⏚ = ANALOG GROUND
6. ⏚ = CHASSIS GROUND
7. ⌐ ¬ DENOTES COMPONENTS
   └ _ ┘NOT STUFFED.

PROJ 1 INPUT J7
PROJ 2 INPUT J8
J101 CAT.NO.510 PREAMP/BYPASS
J102 CAT.NO.511 MAIN BOARD
J103 CAT.NO.222SR/A 2CH NR MODULE
REMOTE CONTROL J10
OUTPUT LEVEL RANGE LINKS
BOOTH MONITOR OUTPUT J9

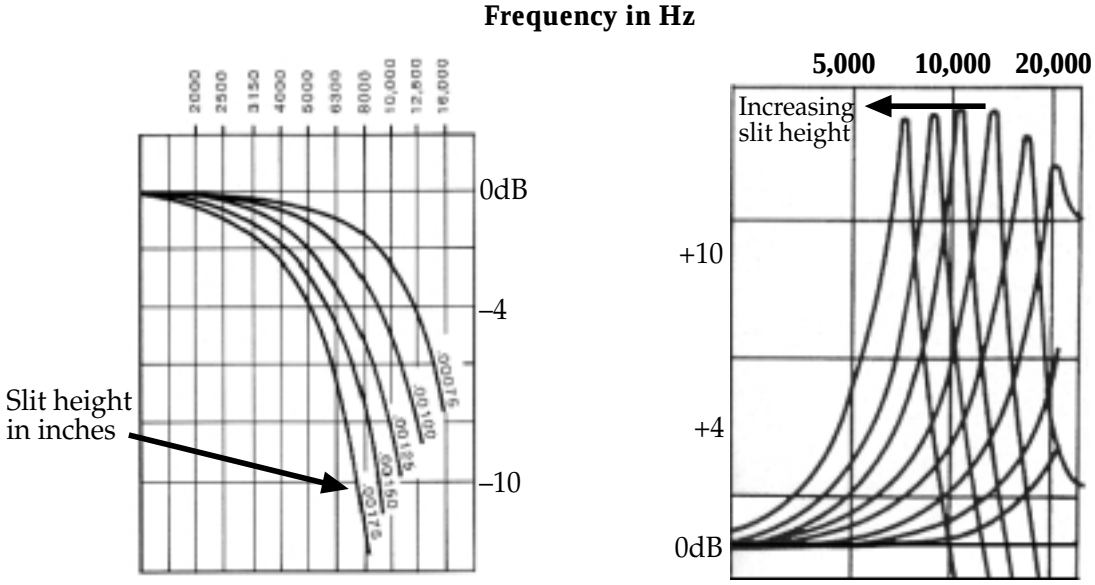
CP45
BACKPLANE SCHEMATIC

APPENDIX A
EFFECT OF CHANGES IN SLIT HEIGHT ON SLIT LOSSES

The slit has a finite height that cannot be reduced without a simultaneous reduction in the light output and, thus, the electrical output of the system. The exciter lamp supply output could be increased in an effort to compensate, but this would shorten the life of the lamp. Equally, the cell preamplifier gain could be increased, but this could cause unwanted hum and noise. The slit acts essentially as a high-frequency filter that has a sharp roll-off to a null at the specific frequency at which the slit height is equal to a recorded wavelength. High-frequency roll-off of the optical cell output is dictated by this slit loss that is, in turn, a function of the wavelength at which these physical factors are equal. The resulting cancellation frequency varies almost exclusively with the height of the slit. The shape of the roll-off curve is essentially independent of the height of the slit; only the cancellation frequency depends on it.

Unfortunately, a conventional treble control cannot compensate for the slit loss characteristic because of its fixed turnover frequency and the gradual slope of the curve. What is needed is a curve that precisely complements the slit loss function by the provision of a boost that can be shifted in frequency to compensate for various slit heights. This is provided by the Dolby optical preamplifiers contained in the Cat. No. 510.

The figures below show the slit losses at the indicated frequencies and the equalization circuit characteristic for slit heights from 0.00075 to 0.00175 inch (0.018375 mm to 0.042875 mm).



Slit Loss

Cat. No. 510 Equalization